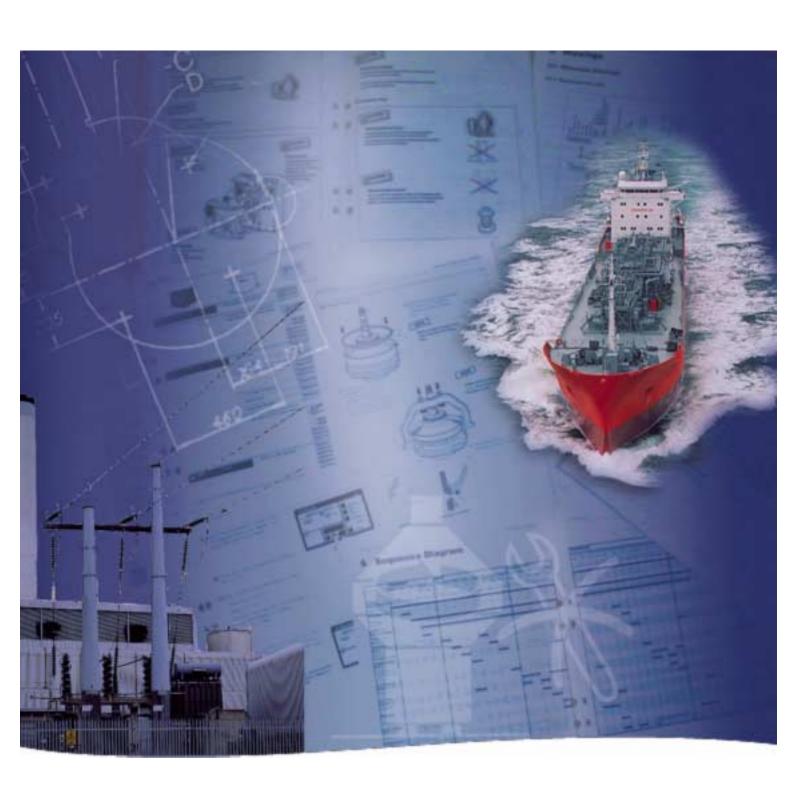
Service Manual



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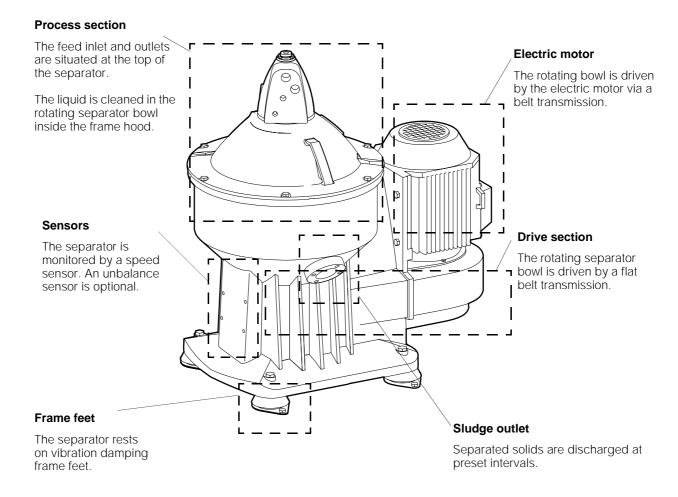
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1 Separator Design



1.1 Overview

The separator comprises a process section and a drive section powered by an electric motor.

The separator frame comprises a lower body and a frame hood. The motor is attached to the frame. The frame feet dampen vibration.

The bottom part of the separator contains a flat belt transmission, a centrifugal clutch and a vertical spindle. The lower body also contains an oil bath for lubrication of spindle bearings. 370641

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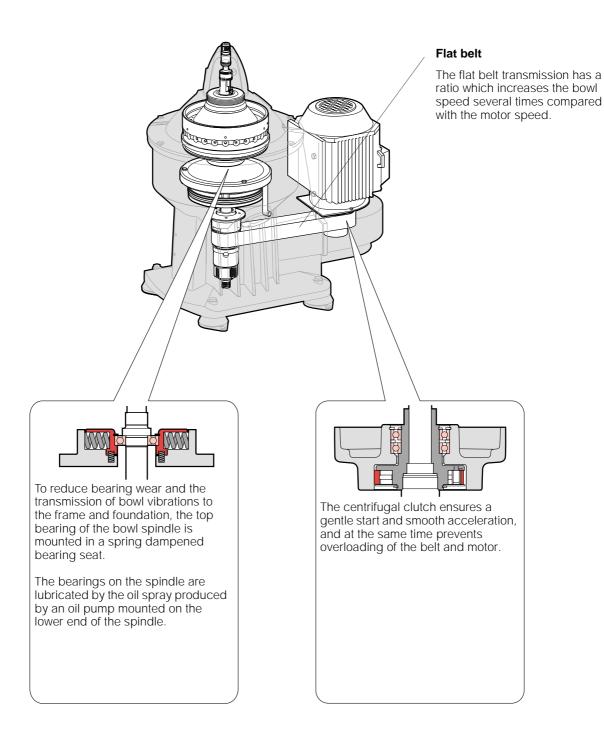
The frame hood contains the processing parts of the separator; the inlets, outlets and piping.

The process liquid is cleaned in the separator bowl. The bowl is fitted on the upper part of a vertical spindle and rotates at high speed inside the frame hood. The bowl also contains the discharge mechanism which empties the sludge during operation.

A speed sensor and an unbalance sensor (option) are part of the equipment for monitoring the separator functions.

1.2 The Drive Section

The separator bowl is driven by an electric motor via a belt transmission. The belt pulley on the motor shaft includes a centrifugal clutch.



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1.3 The Process Section

The separation process takes place inside the rotating separator bowl. The feed and outlet of process liquid takes place in the in and outlet unit on top of the separator frame hood.

Inlet and outlet

The inlet and outlet unit consists of the following parts:

A connection house for pipe connections.

A pipe with a paring disc and a paring tube is located inside the connection house. The pipe has channels for incoming and outgoing process liquid.

The paring disc and paring tube pump the cleaned oil and water respectively out of the bowl.

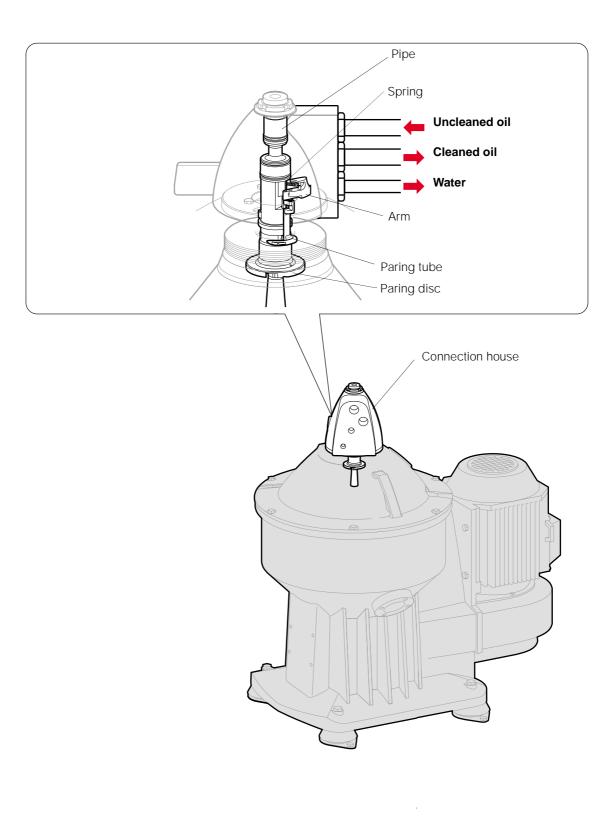
The paring tube can move radially. During separation it surfs on the liquid surface. It is balanced by a spring.

Under certain operating conditions, the paring tube radial position can be locked in place by two adjustable screws on the connection house.

The paring disc and tube are located inside and at the top of the separator bowl.

The inlet and outlet device is held together against the frame hood by a nut on the end of the inlet pipe.

Height adjusting rings determine the height position of the paring disc and paring tube relative to the bowl.



Separator bowl

The separator bowl, with its sludge discharge mechanism, is built-up as follows:

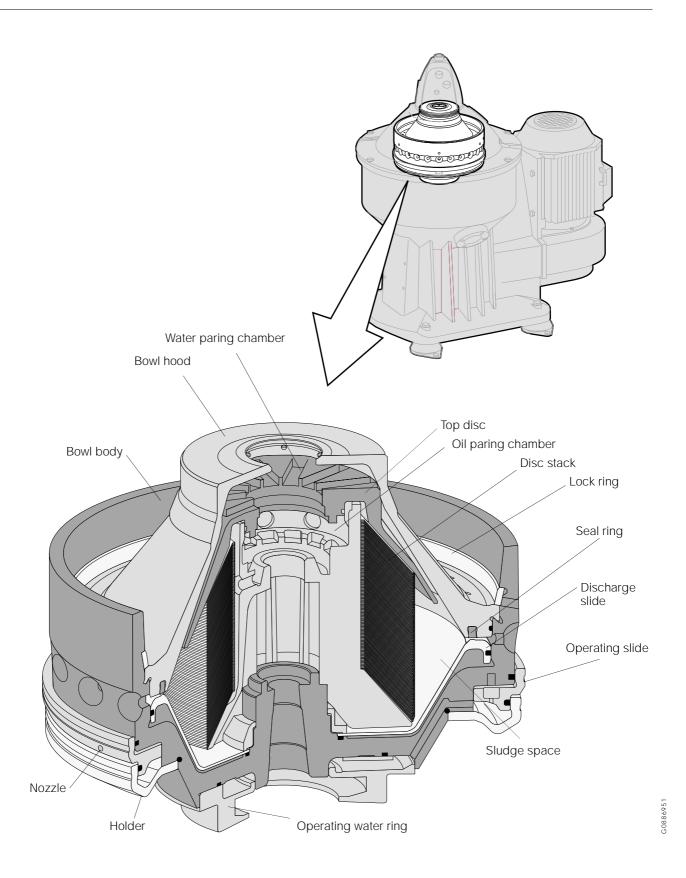
The bowl body and bowl hood are held together by a lock ring (Centrilock). Inside the bowl are the distributor and the disc stack. The disc stack is kept compressed by the bowl hood. The discharge slide forms a separate bottom in the bowl body.

The upper space between the bowl hood and the top disc forms the water paring chamber and contains the paring tube, which pumps the separated water out of the bowl. The oil paring chamber, with its paring disc, is located inside the top of the distributor. From here the cleaned oil is pumped out of the bowl.

The sludge space is in the bowl periphery. The bowl is kept closed by the discharge slide, which seals against a seal ring in the bowl hood.

At fixed intervals, decided by the operator, the discharge slide drops down to empty the bowl of sludge.

The sludge discharge mechanism, which controls the movement of the discharge slide, is comprised of an operating slide and an operating water device. Passive parts are: nozzle and valve plugs. The operating water cover, beneath the bowl, supplies operating water to the discharge mechanism via the operating water ring.



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1.4 Sensors

The separator is equipped with a speed sensor. As options, an unbalance sensor and an interlocking kit can be fitted.

Speed sensor

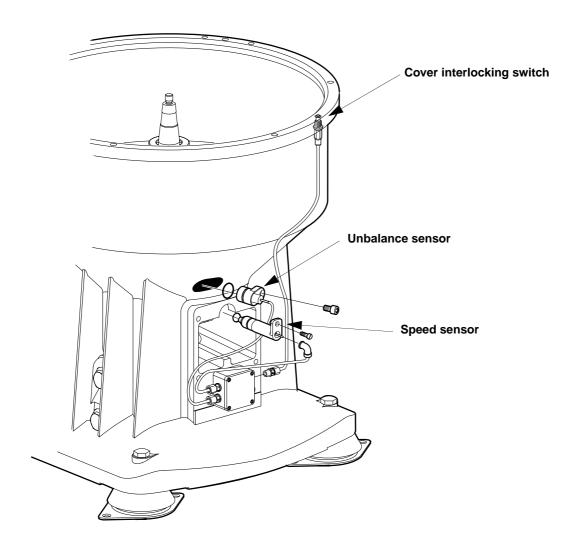
A speed sensor indicates the speed of the separator. The correct speed is needed to achieve the best separating results and for reasons of safety. Refer to name plate for speed particulars.

Monitoring kit (option)

For indication of any abnormal unbalance, the separator can be equipped with a sensor monitoring the radial position of the bowl spindle.

Cover interlocking kit (option)

When the cover is closed the interlocking circuit in the control system is closed which makes it possible to start the separator.



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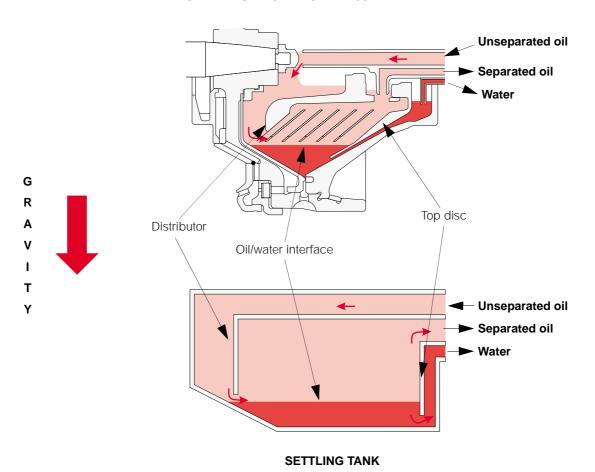
1.5 Separating Function

The separator separates water and solids from the uncleaned oil. Water normally leaves the separator through the water outlet. During sludge discharge, solids (sludge) and water are removed through the discharge ports.

1.5.1 The liquid balance in the bowl

The liquid levels in the bowl depend on many factors (bowl geometry, liquid densities, flow rates etc.). To get a picture of how the liquids are distributed in the bowl, imagine that the bowl is at standstill and turned 90° (only influenced by gravity). The bowl can now be compared with a settling tank:

SEPARATOR BOWL TURNED 90°



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1.5.2 Liquid flow

Unseparated oil is fed into the bowl through the inlet pipe and travels via the distributor towards the periphery of the bowl.

When the oil reaches slots in the distributor, it rises through the channels formed by the disc stack, where it is evenly distributed.

The oil is continuously cleaned as it travels towards the centre of the bowl. When the cleaned oil leaves the disc stack, it flows through a number of holes in the distributor and enters the oil paring chamber. From here it is pumped by the oil paring disc, and leaves the bowl through the oil outlet. Separated water, sludge and solid particles, which are heavier than the oil, are forced towards the periphery of the bowl and collect in the sludge space.

The space between the bowl hood and top disc, as well as the water paring chamber, is filled with oil, which is distributed over the entire circumference via the grooves in the top disc.

During normal operation, the water drain valve in the water outlet is closed.

1.5.3 Discharge of sludge and water

As the sludge space fills up and water enters the disc stack, traces of water will escape with the cleaned oil. The increase of water content in the cleaned oil is the sign of reduced separation efficiency.

This condition is monitored by the process control system, and water is removed from the bowl when minimal levels are recorded.

The water is removed by either of two ways:

- The water drain valve opens and the water leaves the bowl through the water outlet.
- Through the sludge ports at sludge discharge.

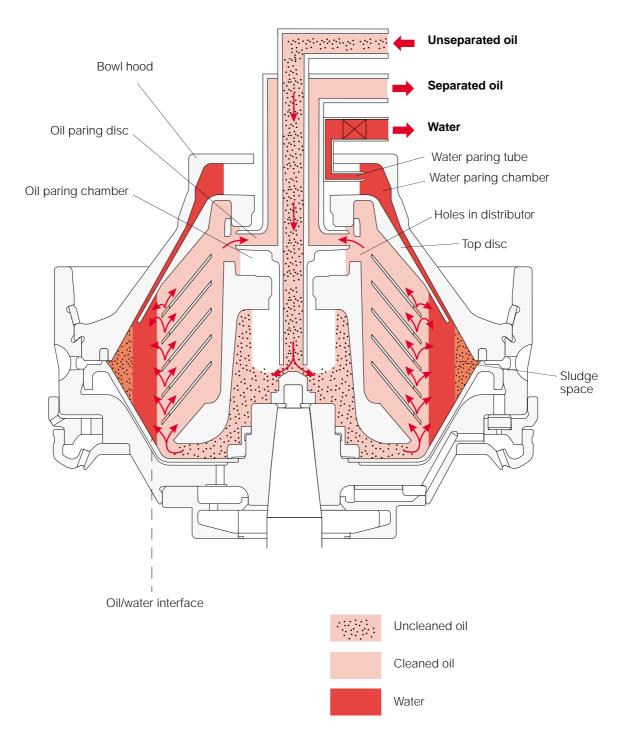
Which way is decided by the process control system.

1.5.4 ALCAPTM concept

When the sludge space is filled up and water enters the disc stack, traces of water will escape with the cleaned oil. The increase of water content in the cleaned oil is the sign of reduced separation efficiency.

This condition is monitored by the process control system, and water is removed from the bowl when minimal levels are recorded.

DISCHARGE OF WATER THROUGH WATER OUTLET



30886231

2 Technical Reference

2.1 Technical Data

Alfa Laval ref. 569604 rev. 2



The separator is a component operating in an integrated system including a monitoring system. If the technical data in the system description does not agree with the technical data in this instruction manual, the data in the system description is the valid one.

Product number: 881203-03-01

Separator type: S 840

Application: Cleaning of fuel and lube oil.

Technical design: Intended for marine- and land

installations.
Total discharge.

Designed in accordance with standards:

98/37EC	The Directive of the European Parliament except for the council relating to the machinery.
89/336EEC	EMC and amendments related to said directive.
EN 292-2	Safety of machines. Use of the machine in applications subject to hygienic demands requires a well adapted cleaning program.

Restrictions:

Feed temperature: 0°C to +100°C

Ambient temperature +5°C to +55°C

Discharge intervals: min. 2 minutes max. 4 hours.

Maximum allowed density of operating liquid: 1000

kg/m³.

Viscosity max. 700 cSt at 50°C.

Not to be used for liquids with flashpoint below 60°C.

Remote restart allowed under certain conditions, see Interface description.

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Alfa Laval ref. 562576 rev. 3

Subject	Value	Unit
General technical data:		
Motor power	9,5	kW
Gear ratio	292 / 82	50Hz
Gear ratio	243 / 82	60Hz
Alarm levels for vibration monitor, connection 752, 1st/2nd	0,3 / 0,45	mm/s
Bowl max. inner diameter	279	mm
Discharge interval, min./max.	2/240	minutes
Max. density of operating liquid, max.	1000	kg/m³
Max. density of feed/sediment	1100 / 2425	kg/m³
Feed temperature, min./max.	0 / 100	°C
Max. running time without flow,		
- empty bowl	60	minutes
- filled bowl	60	minutes
Bowl body material	AL 111 2377-02	
Operating data:		
Bowl speed, synchronous	9220/9220	r/min 50Hz/60Hz
Motor speed synchronous	3000 / 3600	r/min 50Hz/60Hz
Max. power consumption	12	kW (at starting up) (50Hz/60 Hz)
Power consumption	3 / 7,5	kW (idling/at max. capacity)
Starting time, min./max.	1,7 / 2,3	minutes
Stopping time min./max.	25 / 30	minutes
Sound power	9,1	Bel(A)
Sound pressure	76	dB(A)
Vibration level, max.	5,6 / 9,1	mm/sec (new sep./sep. in use)
Volume and capacity data:		
Max. hydraulic capacity, bowl	12	m³/h
Bowl liquid volume	4,3	litres
Fixed discharge volume	4	litres
Sludge volume, efficient/total	0,65 / 1,8	litres
Lubricating oil volume	2,7	litres
Weight information:		
Motor drive	84	kg
Bowl	74	kg
Separator total	445	kg

2.2 Connection List

Alfa Laval ref. 562527 rev. 2

No.	Description	Requirements/limits
201	Inlet for process liquid Allowed temperature Max allowed density Allowed flow	Min. 0 °C, max. 100 °C See demand specification Max 9 m ³ /h
		Max o III /II
206	Inlet for conditioning and displacement liquid Instantaneous flow	1,6 litres/minute
220	Outlet for light phase, clarified liquid	
	Counter pressure	0 - 250 kPa
221	Outlet for heavy phase	No counter pressure.
222	Outlet for solid phase	
	Small discharge	Total discharge
	Large discharge	Max 24 discharge/h.
	Discharge frequency	The outlet from the cyclone must always be arranged to prevent the cyclone from being filled up with sludge. Solids are discharged by gravity.
375	Inlet for discharge and make-up liquid	
	Quality requirements	See 'Technical Data' in the <i>Installation</i> System Reference.
	Max density	Max. 1000 kg/m ³
	Pressure	min. 150 kPa
	Make-up liquid	
	Flow (momentary)	2,8 litres/minute
	Consumption	1,7 litres/hour
	Interval	5 minutes
	Time	3 seconds
	Discharge liquid	
	• Flow	11 litres/minute
	Consumption	0,55 litres/discharge
	• Time	3 seconds
	Closing liquid	
	• Flow	2,8 litres/minute
	Consumption	0,7 litres/discharge
	• Time	15 seconds
462	Drain of frame top section, lower	

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701	Motor for separator			
	Allowed frequency variation:	± 5%		
	(momentarily during 5 seconds)	± 10%		
740	Speed sensor for bowl spindle	See page 21.		
	• Type	Inductive promixly switch		
	Supply voltage, nominal	8 V		
	With sensor activated (near metal)	Less or equal to 1 mA.		
	With sensor not activated (far from metal)	More or equal to 3 mA.		
	Number of pulses per revolution	1		
752	Position transducer for bearing holder	See page 22.		
	• Type	Inductive analogue sensor		
	Supply voltage	18 to 30 V DC		
	Operation range (mild steel)	0,5 to 2,5 mm		
	Output voltage within sensing range	1 to 9 mA		
	Load resistance, R _L	400 Ohm		
760	Cover interlocking switch			
	• Type	Mechanical limit switch		
	Switch rating, resistive load max.	3 A (at 48 V DC) 1 A (at 220 V AC)		

2.3 Interface Description

Alfa Laval ref. 564834 rev. 2

2.3.1 Scope

This document gives information, requirements, and recommendations about operational procedures and signal processing for safe and reliable operation of the separator. It is intended to be used for designing auxiliary equipment and control systems for the separator.

2.3.2 References

This Interface Description is one complementary document to the separator. Other such documents that contain necessary information and are referred to here are:

- Interconnection Diagram
- Connection List
- Technical Data

Standards referred to are:

- EN 418 Safety of machinery Emergency stop equipment, functional aspects - Principles of design
- EN 1037 Safety of machinery Prevention of unexpected start-up
- EN 954-1 Safety of machinery Safety related parts of control systems - Part 1 General principles for design.

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2.3.3 Definitions

For the purpose of this document, the following definitions apply:

- Synchronous speed: The speed the machine will attain when it is driven by a three phase squirrel-cage induction motor and there is no slip in the motor and the drive system.
- Full speed: The synchronous speed minus normal slip.

2.3.4 Goal

To eliminate situations that can cause harm, i.e. injury, damage to health or property and unsatisfactory process result are e.g.:

Situation	Effect
Unbalance caused by uneven sediment accumulation in the bowl.	Too high stress on bowl and bearing system which might cause harm.
Too high bowl speed.	Too high stress on bowl which might cause harm.
Access to moving parts.	Can cause injury to person who accidentally touches these parts.
Insufficient cleaning of separator.	Unsatisfactory product quality.
Bowl leakage.	Product losses.

Information and instructions given in this document aim at preventing these situations.

Control and supervision can be more or less comprehensive depending on the type of used control equipment. When a simple control unit is used it would be impossible or too expensive to include many of the functions specified here while these functions could be included at nearly no extra cost when a more advanced control unit is used. For this reasons functions that are indispensable or needed for safety reasons to protect the machine and/or personnel are denoted with *shall* while other functions are denoted with *should*.

2.3.5 Description of separator modes

For control purposes the operation of the separator should be divided into different modes.

The normally used modes are described below but other modes might exist.

It is assumed that:

- The separator is correctly assembled.
- All connections are made according to Connection List, Interconnection Diagram and Interface Description.
- The separator control system is activated.

If above conditions are not fulfilled the separator will be in *SERVICE* mode.

Stand still means:

- The power to the separator motor is off
- The bowl is not rotating.

Starting means:

- The power to the separator motor is on.
- The bowl is rotating and accelerating

Running means:

- The power to the separator motor is on.
- The bowl is rotating at full speed.
- *RUNNING* is a collective denomination for a number of sub modes which e.g. can be:
 - STAND BY: Separator is in a waiting mode and not producing.
 - PRODUCTION: Separator is fed with product and producing.
 - CLEANING: Separator is fed with cleaning liquids with the intention to clean the separator.

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Stopping means:

- The power to the separator motor is off.
- The bowl is rotating and decelerating.
- *STOPPING* is a collective denomination for a number of sub modes which e.g. can be:
 - NORMAL STOP: A manually or automatically initiated stop.
 - SAFETY STOP: An automatically initiated stop at too high vibrations.
 - EMERGENCY STOP: A manually initiated stop at emergency situations. This stop will be in effect until it is manually reset.

2.3.6 Remote start

This machine may be started from a remote location under the following conditions;

- First start after any kind of service or manual cleaning must be supervised locally in order to ensure that no mistakes has been made during assembly.
- The unbalance sensor is mandatory for remote start.
- The installation must include equipment to prevent unintentional start-up from remote location when the machine is disassembled.
- The installation must include equipment to prevent unintentional start of process flow from remote location when the machine is not properly connected to the piping.

2.3.7 Handling of connection interfaces

Electrical connections

701 Separator motor.

The separator is equipped with a 3-phase DOL - (direct on line) started motor. The separator can also be started by a Y/D starter, but then the time in Y-position must be maximized to 5 seconds.

There shall be an emergency stop circuit designed according to EN 418 and a power isolation device according to EN 1037.

There shall be a start button close to the separator that shall be used for first start after assembly of the separator.

There should be a counter to count number of running hours.

There should be a current transformer to give an analogue signal to the control unit about the motor current.

740 Speed sensor

A proximity sensor of inductive type according to DIN 19234 (Namur) standard is giving a number of pulses per revolution of the bowl (see *Connection List*).

Signal processing in STARTING:

- The separator should be stopped automatically according to NORMAL STOP procedure and an alarm should be given when the accumulated time for acceleration is longer than the maximum time specified in Technical Data. An abnormal start time indicates some malfunction of the separator equipment and should be investigated.
- If the speed exceeds "Bowl speed, synchronous" in Technical Data with more than 5% the separator shall be stopped automatically by *NORMAL STOP* and a high speed alarm shall be given.
- The speed monitoring system shall be checked continuously (e.g by checking that pulses are coming). In case of failure indication the separator shall be stopped automatically by NORMAL STOP with a timer controlled stop sequence and an alarm for speed monitoring system failure shall be given.
- The acceleration should be supervised to ensure that a certain speed (e.g 250r/min.) has been reached within a certain time (e.g 30 seconds).

Signal processing in *RUNNING*:

- If the speed exceeds "Bowl speed, synchronous" in *Technical Data* with more than 5% for a period longer than 1 minute or momentarily during maximum 5 seconds more than 10% the separator shall be stopped automatically by *NORMAL STOP* and a high speed alarm shall be given.
- If the speed falls more than 10% below the synchronous speed for a period longer than 1 minute or 15% during more than 5 seconds a low speed alarm should be given. Low speed indicates some malfunction of the separator equipment and shall be investigated.
- The speed monitoring system shall be checked continuously (e.g. by checking that pulses are coming). In case of a failure indication an alarm for speed monitoring system failure shall be given. If there is a risk of too high speed the separator shall be stopped by NORMAL STOP.
- The speed drop during DISCHARGE. compared to the measured speed immediately before, should be between 3-8% which will indicate a proper discharge.

Signal processing in *STOPPING*:

- STAND STILL shall be indicated when no pulses are detected within 30 seconds.
- Stopping the separator when alarm for speed monitoring system failure is active, shall cause a timer controlled stop. (See "Stop time" in Technical Data.)

752 Unbalance sensor (option).

For indication of any abnormal unbalance and to be able to perform appropriate countermeasures, the separator has been equipped with a vibration velocity transducer on the separator frame. The signal from the transducer shall be monitored and two alarm levels according to the vibration alarm levels in *Technical Data* should be set.

The vibration level shall be high for 3 seconds to generate an alarm. The first level is only used to generate an alarm while the second level shall stop the machine.

The vibration monitor shall include self check function to be performed at least at initiation of *STARTING*.

If vibrations exceed the second alarm level the separator shall be stopped the quickest way possible and it shall not been restarted until the reasons for the unbalance have been found and measures to remove them have been taken.

Signal processing in *STARTING*:

If vibrations exceed the second alarm level the separator shall be stopped automatically by *SAFETY STOP*.

If the self check system triggers, an alarm shall be given and an automatic stop by *NORMAL STOP* shall be initiated.

Signal processing in *RUNNING*:

- If vibrations exceed the first alarm level an alarm should be given. Vibrations of this magnitude will reduce the expected life time of the bearings and should therefore be eliminated.
- If vibrations exceed the second alarm level the separator shall be stopped automatically by SAFETY STOP.
- If the self check system triggers, an alarm shall be given.

Signal processing in STOPPING:

• If the self check system triggers, an alarm shall be given.

Signal processing in NORMAL STOP:

 If vibrations exceed the second level the system shall turn over automatically to SAFETY STOP.

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760 Cover interlocking switch (option)

The separator is equipped with a interlocking switch to detect if the cover is mounted.

Signal processing in STAND STILL:

- The circuit is closed when the cover of the separator is mounted.
- The interlocking switch should be connected in such a way that starting of the motor is prevented when the separator cover is not mounted.

Signal processing in *STARTING*, *RUNNING* and *CLEANING*:

 If the circuit is broken the separator should be stopped automatically by NORMAL STOP.
 This is to minimise the risk of having access to moving parts.

Fluid connections

Complementary information is given in the document Connection List.

201 Inlet

Processing in *STAND STILL*:

Shall be closed.

Processing in *STARTING*:

 Should be closed. Bowl will be open and empty or closed and filled depending on if start is done from STAND STILL or STOPPING.

Processing in *RUNNING*:

Could be closed or open.

Processing in *CLEANING*:

 A sequence of cleaning liquids should be fed to the separator. The flow rate should be as high as possible and preferably not less than the production flow rate.

Processing in *NORMAL STOP* or *EMERGENCY STOP*:

 Could be closed or open but the bowl should be filled unless the stop is initiated in STARTING.

Processing in SAFETY STOP:

 Could be closed or open but the bowl shall be filled unless the stop is initiated in STARTING.

206 Inlet for conditioning and displacement liquid

According to process

220, 221 and 222 Outlets

Processing in *STAND STILL*:

Could be closed or open.

Processing in other modes:

Shall be open.

375 Inlet for discharge and make-up liquid

Processing in all modes:

 It is recommendable to supervise the supply pressure. If pressure is too low (see Connection List), start should be interlocked and if it happens in *PRODUCTION* or *CLEANING* turn over to *STAND BY* should take place.

Signal processing in *STARTING:*

- Below 85 % of synchronous bowl speed no water supply may be made.
- When coming from PRODUCTION a
 discharge shall be initiated to remove
 sediments from bowl to avoid problems due to
 solidification, see Connection List.

Signal processing in *PRODUCTION:*

 Automatic discharges shall be initiated by timer or ALCAP system.

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Signal processing in *CLEANING:*

 Automatic discharges shall be initiated by timer or CIP-control system.

Signal processing in NORMAL STOP:

Discharges should not be made.

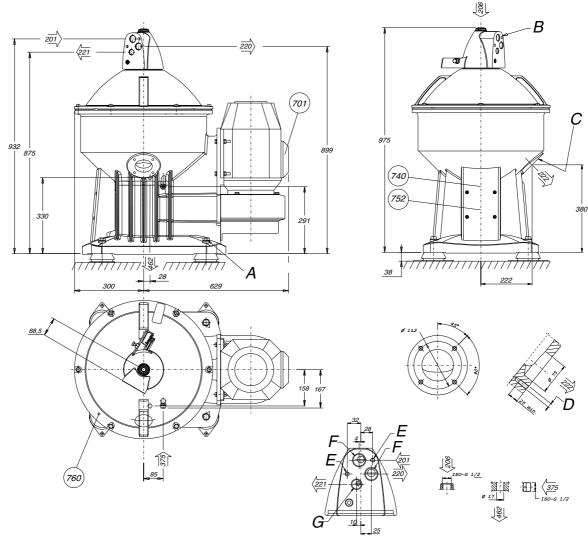
Signal processing in *SAFETY STOP* and *EMERGENCY STOP*:

• Discharges should not be made.

2.4 Drawings

2.4.1 Basic size drawing

Alfa Laval ref. 562557 rev. 3



Connection house, with connections 201, 220 and 221, turnable in 60° steps all around.

All connections to be installed non-loaded and flexible

All dimensions are nominal. Reservation for individual deviations due to tolerances.

Data for connection, see 2.2 Connection List, page 15.

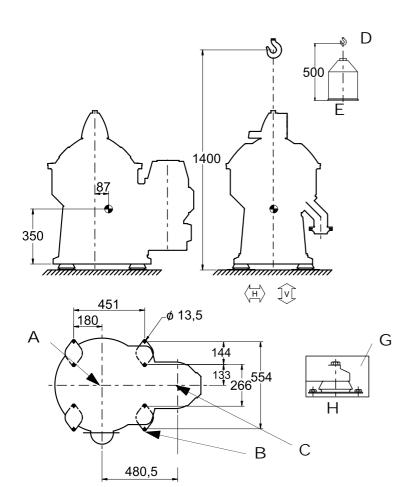
- A Tightening torque 160 Nm.
- B Maximum horizontal displacement at the inlet and outlet connections during operation \pm 5 mm.
- C Maximum vertical displacement at the sludge connection during operation \pm 2 mm.
- D 4 holes M10
- E M10 depth 30
- F ø28, depth 45
- G ø22, depth 45

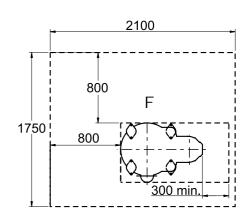
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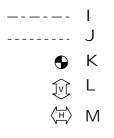
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2.4.2 Foundation drawing

Alfa Laval ref. 562553 rev. 1







Total static load max. 4,5 kN.

1177700

- A Centre of separator bowl.
- B Holes for foundation bolts (8x).
- C Centre of motor.
- D Min. lifting capacity required during service: 300 kg.
- E Max. height of largest component incl. lifting tool.
- F Service side
- G Foundation bolts.
- H Installation according to stated foundation force.
- I Recommended free floor space for unloading when doing service.
- J No fixed installation within this area.
- K Centre of gravity (complete machine).
- L Dynamic forces (static force excluded)

From separator do not exceed;

Force in any separator feet;

Vertical ± 12 kN

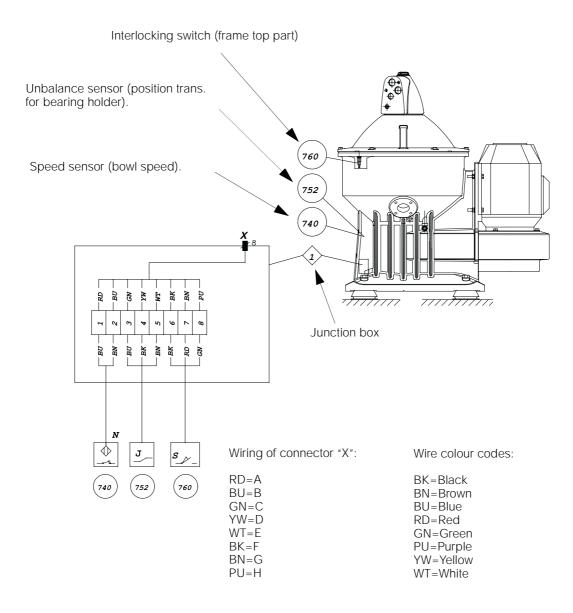
Horizontal ± 12 kN

M Total foundation force (sum of all feet)

Vertical ± 12 kN Horizontal ± 12 kN

2.4.3 Interconnection diagram

Alfa Laval ref. 561786 rev. 4

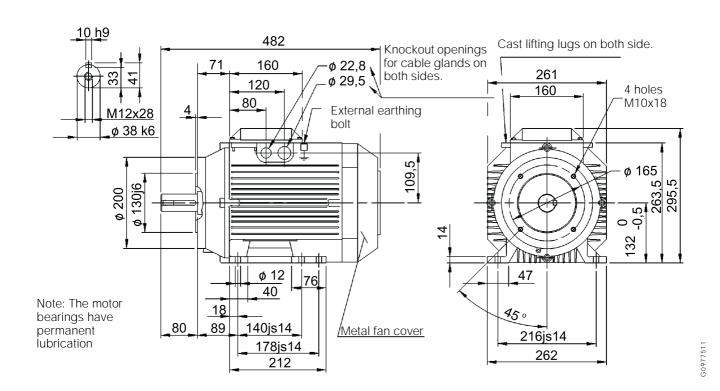


Items showed in this document are not included in all separators. See product specification.

Demand specification wire Approval: UL 1007/1569 CSA TR-64 Area acc. to AWG 18 0867541

2.4.4 Electric motor

Alfa Laval ref. 562534 rev.2



Manufacturer ABB Motors

Manuf. drawing Cat. GB 96-10

Standards IEC 34-series, 72, 79 and 85

Size 132 SC

Type M2AA 132 SC

Weight 56 kg
Poles 2
Insulation class F

Bearings D-end 6208-2Z/C3

N-end 6206-2Z/C3

Method of cooling IC 411 (IEC 34-6)

Spec. Totally enclosed three-phase

motor for marine service 2)

Motor with feet and small flange.

Type of m	Protection class	
Q	IM 1001	
₽	IM 2101	IP 55
Ģ	IM 2111	IP 55
å	IM 2131	IP 55

Article	Output	Speed	Freq	Voltage		Pow.fac	st / ¹⁾	Note
No.	kW	rpm	Hz	V	A	cos j		
562534-17	11	3455	60	690D	11,2	0,93	9,1	
562534-16	11	3455	60	380D	20,3	0,93	9,1	
562534-15	11	3455	60	230 D	33,5	0,93	9,1	-
562534-14	11	3455	60	220 D	35,0	0,93	9,1	
562534-13	11	3455	60	575D	13,4	0,93	9,1	CSA- plated
562534-12	11	3455	60	480D	16,0	0,93	9,1	-
562534-11	11	3455	60	460D	16,7	0,93	9,1	-
562534-10	11	3455	60	440 D	17,5	0,93	9,1	-
562534-9	9,5	2855	50	230 D	29,1	0,94	8,8	-
562534-8	9,5	2855	50	220 D	30,4	0,94	8,8	-
562534-7	9,5	2855	50	690 D	9,7	0,94	8,8	-
562534-6	9,5	2855	50	660D	10,1	0,94	8,8	-
562534-5	9,5	2855	50	500 D	13,4	0,94	8,8	-
562534-4	9,5	2855	50	440 D	15,2	0,94	8,8	-
562534-3	9,5	2855	50	415 D	16,1	0,94	8,8	-
562534-2	9,5	2855	50	400 D	16,7	0,94	8,8	-
562534-1	9,5	2855	50	380 D	17,6	0,94	8,8	-

1) lst /l=starting current /rated current at direction line starting.

2) The motors can be designed to fulfil requirements of following Classification Societies (Essential Service, if required).

Lloyds Register of Shipping (LRS)

Det Norske Veritas (DnV)

Germanischer Lloyd (GL)

Bureau Veritas (BV)

American Bureau of Shipping (ABS)

Registro Italiano Navale (RINA)

Nippon Kaiyi Kyokai (NK)

Korean Register of Shipping (KR)

Polski Rejester Statkow (PRS)

China Classification Societies (ZC)

Indian Register of Shipping (IRS)

Maritime Register of Shipping (IRS)

Required classification society must always be specified when ordering. Factory test certificate to be enclosed at the delivery.

Rated output (kW) valid for temp-rise max. 90 °C.

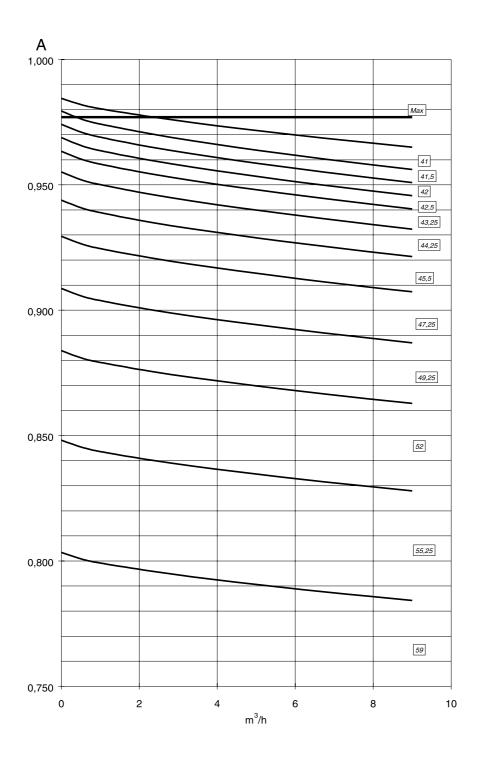
The motors can be provided with space heaters for 110 V or 220 V, 25 W as option.

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2.5 Nomogram paring tube

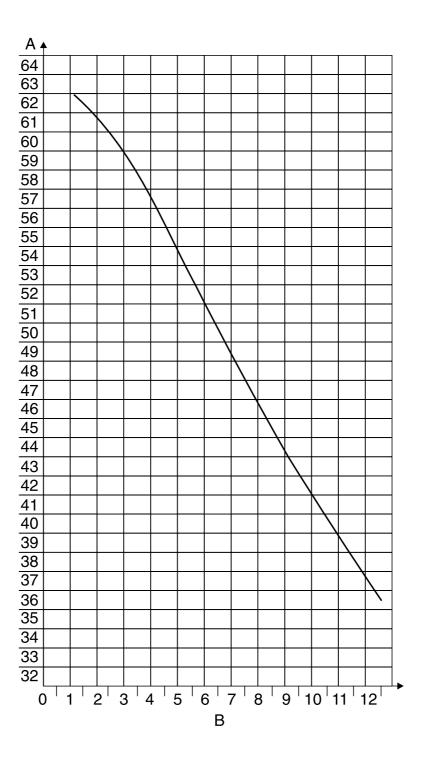
Alfa Laval ref. 566504, rev. 0

Calculated level ring ø 80



A Density ratio

30938051



A Paring radius

B Position of adjusting screw

0

3 Separator Service, Dismantling, Assembly

3.1 Periodic Maintenance

Periodic (preventive) maintenance reduces the risk of unexpected stoppages and breakdowns. Follow the maintenance log in this chapter in order to facilitate the periodic maintenance.

3.1.1 Maintenance intervals

The following directions for periodic maintenance give a brief description of parts to be cleaned, checked and renewed at different maintenance intervals.

The maintenance log for each maintenance interval on page 39 gives a detailed list of actions to be performed.

Inspection 📙

An Inspection consists of an overhaul of the separator bowl, inlet/outlet and operating water device every *6 months* or *4000 operating hours*.

Seals in bowl and gaskets in inlet/outlet device are renewed.

Overhaul O

An Overhaul consists of an overhaul of the complete separator (including separator bowl, inlet/outlet and operating device) every *18 months* or *12000 operating hours*. Seals, bearings, friction blocks and flat belt in the separator are renewed.

Oil change

The oil should be changed every 4000 hours, or at least once every year if the total number of operating hours is less than 4000 hours/year.

3.1.2 Maintenance procedures

At each Inspection and/or Overhaul, take a copy of the maintenance log and use it to make notes during the service.

An inspection and overhaul should be carried out as follows:

- 1 Dismantle the parts as described in 3.3 Dismantling, page 41.
 - Place the separator parts on clean, soft surfaces such as pallets.
- Inspect and clean the dismantled separator parts according to the maintenance log and description in 3.4 Actions Before Assembly, page 74.
- 3 Fit all the parts delivered in the service kit while assembling the separator as described in chapter 3.5 Assembly, page 84.
- 4 When the separator is assembled, make final checks described in 3.6 Actions After Assembly, page 121.



Disintegration Hazards

Separator parts that are either missing, worn beyond their safe limits or incorrectly assembled, may cause severe damage or fatal injury.



Burn and Corrode Hazards

Escaping hot and/or corroding process material, which can be hazardous, may still remain in the separator after stop.

The use of service symbols in the dismantling/assembly instructions

Parts that have to be renewed from the service kits (see below) are marked in and/or in the assembly instructions.

Example:

a Fit the O-ring .

When dismantling and assembling between the service periods, some procedures do not have to be carried out. These procedures are marked and/or .

Example:

5 Renew the valve plugs on the operating slide i.

All symbols used in the instructions refer to activities mentioned in the maintenance logs.

3.1.3 Tightening of screws

Tightening all screws with the correct torque value is important.

These figures apply unless otherwise stated:

Torque								
Metric	Sta	inless	steel	Carbon steel				
thread	Nm	kpm	lb.ft	Nm	kpm	lb.ft		
M6	7	0,7	5	8	0,8	5,9		
M8	17	1,7	13	20	2	14,7		
M10	33	3,4	24	39	3,9	28,7		
M12	57	5,8	42	68	6,9	50		
M16	140	14	100	155	15,8	114		
M20	270	28	200	325	33	239		
M24	470	48	340	570	58	420		

The figures apply to lubricated screws tightened with a torque wrench.

3.1.4 Service kits

Special service kits are available for Inspection and Overhaul.

For other services, a Support kit is available. Spare parts not included in the Support kit have to be ordered separately.

Note that the parts for Inspection **are** included in the Overhaul kit.

The contents of the kits are described in the Spare Parts Catalogue.



Always use Alfa Laval genuine parts as otherwise the warranty may become invalid.

Alfa Laval takes no responsibility for the safe operation of the equipment if non-genuine spare parts are used.



Disintegration hazards

Use of imitation spare parts may cause severe damage.

3.1.5 Cleaning

CIP (Cleaning In Place)

To prolong the intervals between manual cleaning of the separator the use of CIP together with repeated discharges can be used.

Some CIP liquids can be corrosive to brass- and aluminium alloy parts which are included in the separator.



Use only Alfa Laval recommended CIP liquids.

3.2 Maintenance Log

Name of ship/plant:	Local identification:		
Separator: S 840	Manufacture No./Year:		
Total running hours:	Product No.: 881203-03-01		
Date:	Signature:		

Signature:						
Part	Inspection	Overhaul	Check	Action	Page	Note
Frame hood				, (31)	i age	14010
- All parts	Х	Х		Clean	74	
- All parts	X	X		Check for corrosion	76	
- All parts	X	X		Check for cracks	77	
- Connecting housing	X	X		Check for erosion damages	78	
- Frame hood	Х	х		Renew O-ring	115	
		х		Control measure of paring disc height	116	
		х		Check height adjusting rings	116	
Bowl				0 7 0 0		
- All parts	Х	Х		Clean	74	
- All parts	х	Х		Check for corrosion	76	
- All parts	х	х		Check for cracks	77	
- All parts	Х	Х		Check for erosion damages	78	
- Bowl body	х	х		Check for impact marks and corrosion	102	
	х	х		Renew rectangular ring	103	
	х	х		Renew O-rings	104, 107	
- Operating slide	Х	Х		Renew rectangular ring	103	
	х	х		Renew valve plugs	102	
- Discharge slide	х	х		Renew rectangular ring	107	
- In and outlet pipe	х	х		Renew O-rings	110	
- Paring tube	х	х		Renew O-rings and bearings	110	
- Bowl hood	х	Х		Renew seal ring	112	
	Х	Х		Renew O-ring	112	
Frame						
- Frame feet				Renew frame feet (including washers and screws)	80	Has to be ordered separately
- Drain and oil filling holes	х	х		Renew washers	101	
- Oil pin	х	x		Renew O-ring	101	

	Inspection	Overhaul	Check			
Part		0		Action	Page	Note
Driving device						
- All parts		Х		Clean	74	
- All parts		х		Check for corrosion	76	
- All parts		х		Check for cracks	77	
- Bottom bearing housing		x		Renew O-ring	90	
- Labyrinth ring holder		х		Renew labyrinth ring	91	
		х		Renew O-ring	91	
- Top bearing housing		х		Renew springs	93	
- Flat belt		х		Renew flat belt	97	
- Bowl spindle		х		Pre-lubricate and renew ball bearing	92	
		х		Pre-lubricate and renew self-aligning roller bearing	94	
		х		Measure the radial wobble	100	
- Neck bearing cover		х		Renew O-ring	99	
- Deflector ring		х		Renew O-ring	99	
- Water inlet pipe		х		Renew O-ring	100	
- Operating water cover		x		Renew seal ring and O-ring	100	
- Fan		х		Renew the O-ring	96	
Coupling						
- All parts		Х		Clean	74	
- All parts		х		Check for corrosion	76	
- All parts		х		Check for cracks	77	
- Coupling hub		х		Renew single row ball bearings		
- Friction blocks		x		Renew friction pads (if they are worn) or clean the pads if they are oily	84	
Electrical motor						
- Electrical motor		х		Lubricate if nipples are fitted. See sign on motor		
Signs and labels on	sepa	rato	r			
- Machine plate			х	Check attachment and legibility	121	
- Power supply frequency			х	Check attachment and legibility	121	
- Lifting instructions			х	Check attachment and legibility	121	
- Safety labels			х	Check attachment and legibility	121	
- Name plate			х	Check attachment and legibility	121	
- Representative label			x	Check attachment and legibility	121	

3.3 Dismantling

3.3.1 Introduction

To disconnect the oil inlet, oil outlet, and water outlet, undo the two screws on the connection plate. Hook the plate, together with the three hoses, to the edge of the small work table to avoid oil draining from the hoses.

The frame hood and heavy bowl parts must be lifted by means of a hoist. Position the hoist exactly above the bowl centre. Use a lifting sling and lifting hooks with safety catches.

The parts must be handled carefully. Don't place parts directly on the floor, but on a clean rubber mat, fibreboard or a suitable pallet.



For safety reasons, it is essential that all personnel who work with the separator read this manual thoroughly and completely.

Do not allow personnel to clean, assemble, operate or maintain the separator until they have read and fully understood this manual.

Ensure that all personnel who operate and service the separator are well-trained and knowledgeable concerning the separator and the work to be carried out.

3.3.2 Tools

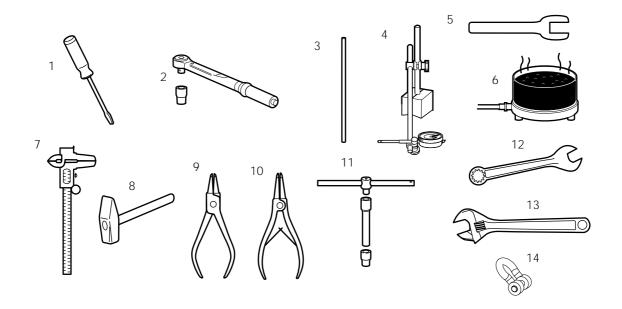
Special tools from the tool kit must be used for dismantling and assembly, as well as **Standard tools** (not included). The special tools are specified in the *Spare Parts Catalogue* and are illustrated at the beginning of each dismantling section.



Entrapment hazard

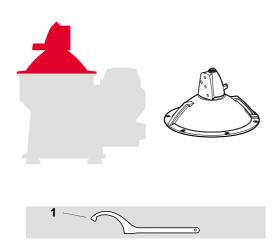
To avoid accidental start, switch off and lock-out power supply before starting any dismantling work.

Make sure that machine has come to a complete standstill before starting any dismantling work (takes about 30 minutes from switch off).



- 1 Screwdriver
- 2 Torque wrench (capacity 0-200 Nm)
- 3 Drift (Ø 4 mm)
- 4 Dial indicator with magnetic base
- 5 Spanner for clutch (55 mm)
- 6 Heating equipment for bearings
- 7 Sliding calliper
- 8 Hammers (standard and soft-faced)
- 9 Pliers for internal snap rings
- 10 Pliers for external snap rings
- 11 T-handle with extension rod, sockets (13, 16, 17, 18, 19, 27, 30 mm)
- 12 Spanners (various sizes)
- 13 Adjustable spanner
- 14 Shackle

3.3.3 Frame hood



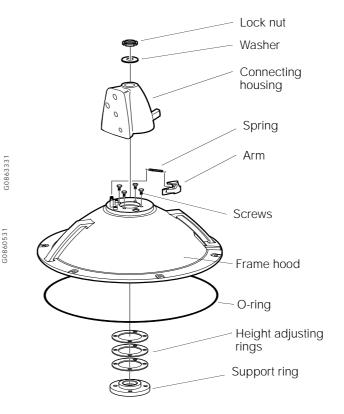
1 Hook spanner (lock nut)

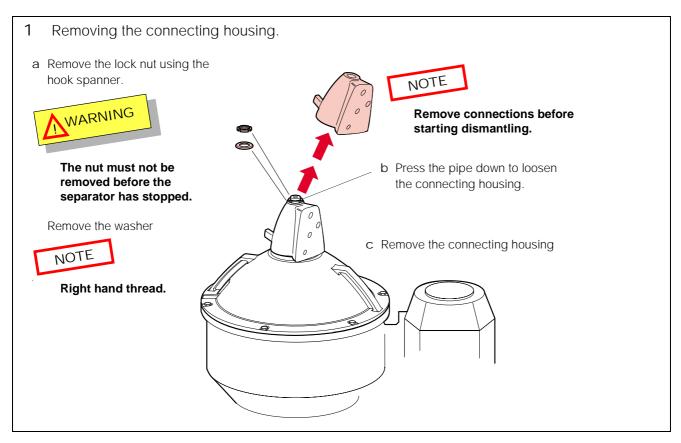


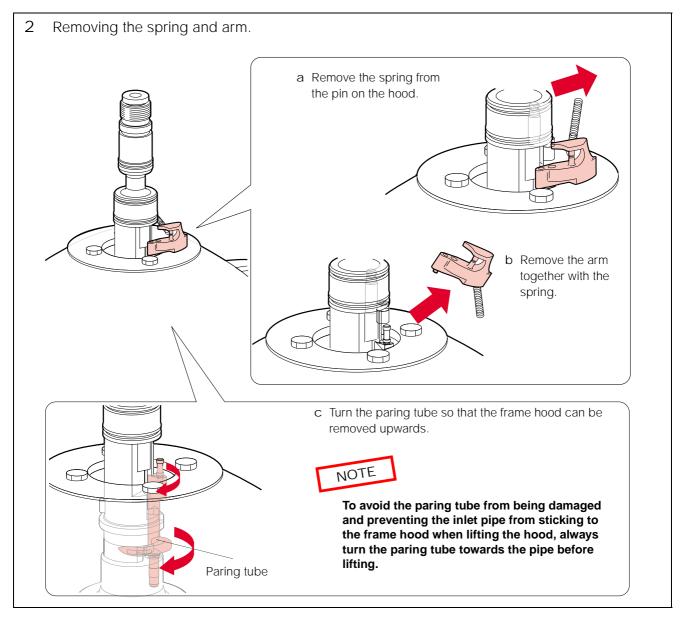
Entrapment hazard

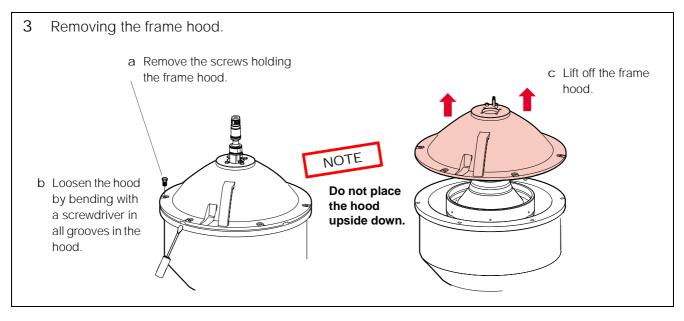
To avoid accidental start, switch off and lock-out the power supply before starting any dismantling work.

Make sure that machine has come to a complete standstill before starting any dismantling work (after about 30 minutes from switch off).

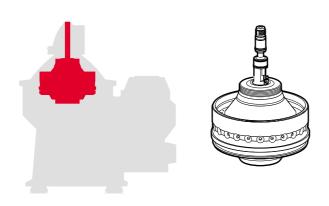


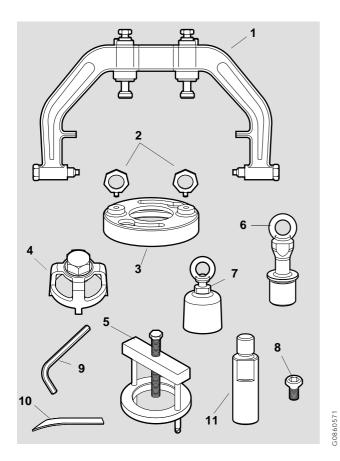




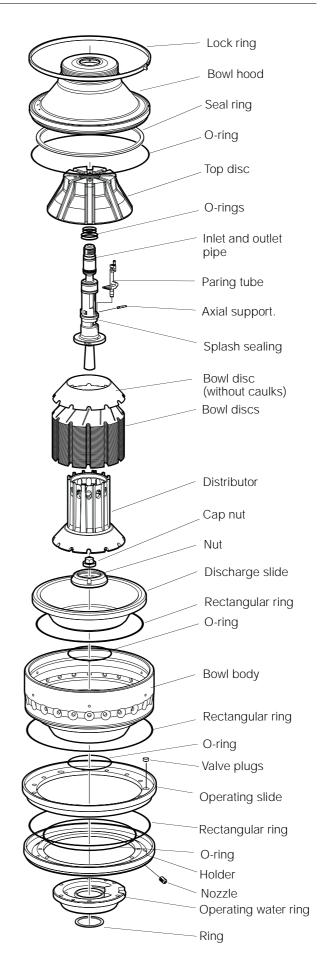


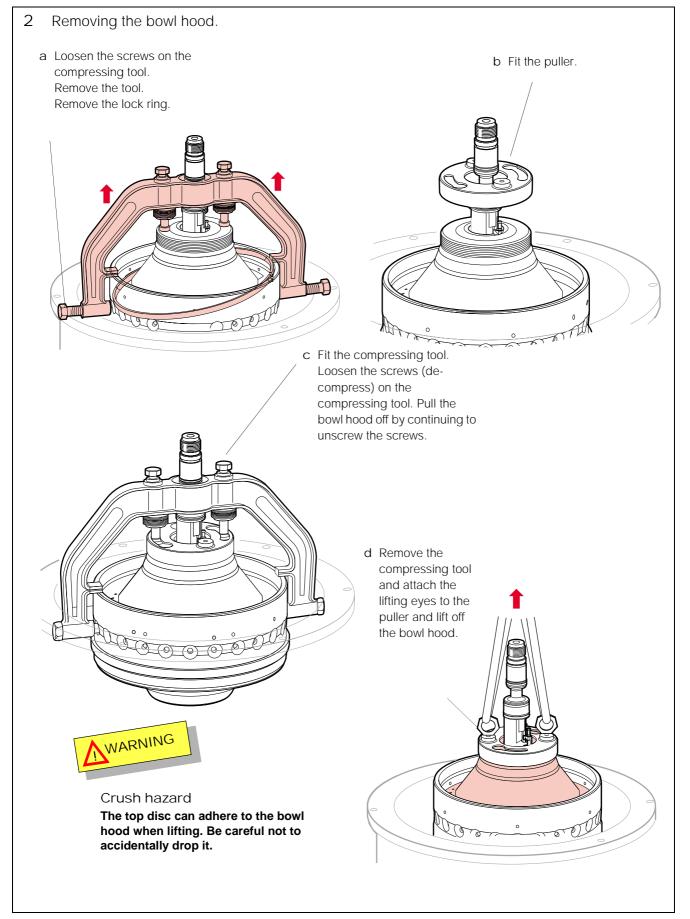
3.3.4 Bowl





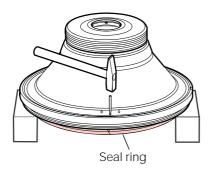
- 1 Compressing tool (lock ring).
- 2 Lifting eyes.
- 3 Bowl hood puller.
- 4 Spanner for nut (nut/discharge slide).
- 5 Puller (discharge slide).
- 6 Lifting tool (distributor, spindle).
- 7 Puller (Bowl body)
- 8 Screw (lock ring) (M5)
- 9 Hexagon head key
- 10 Chisel (seal ring)
- 11 Pin (distributor/lifting tool)





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- 3 Removing the seal ring.
 - a Place the bowl hood on a support and tap out a piece of the seal ring using a drift in the holes.

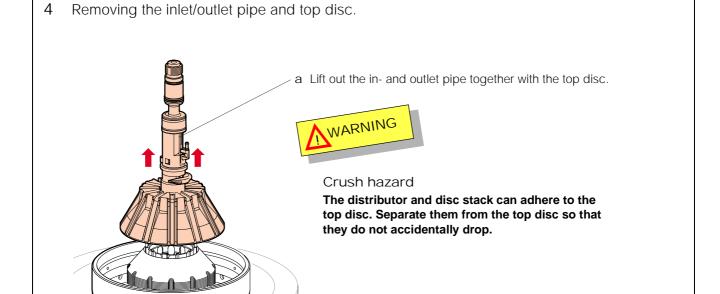


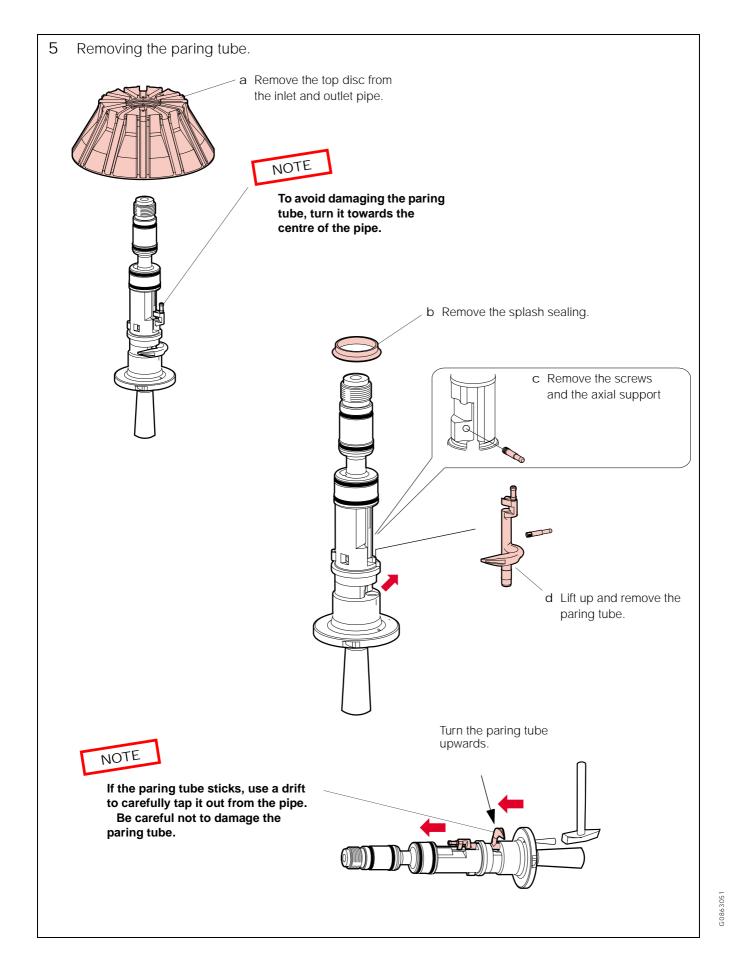


Risk for eye injury from flying seal ring parts or from splashing fluid

The seal ring breaks when removed from the bowl hood and may cause trapped fluid to splash. Wear safety goggles. b Turn the bowl hood upside down and remove the seal ring by carefully knock pieces of the seal ring out of the groove, using the special tool: chisel.

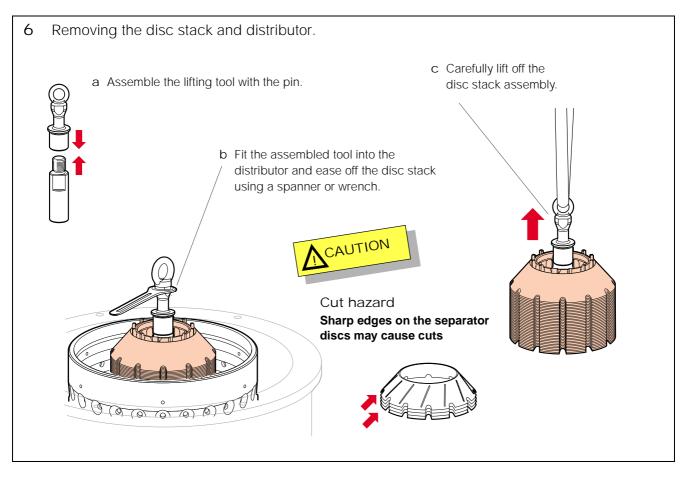


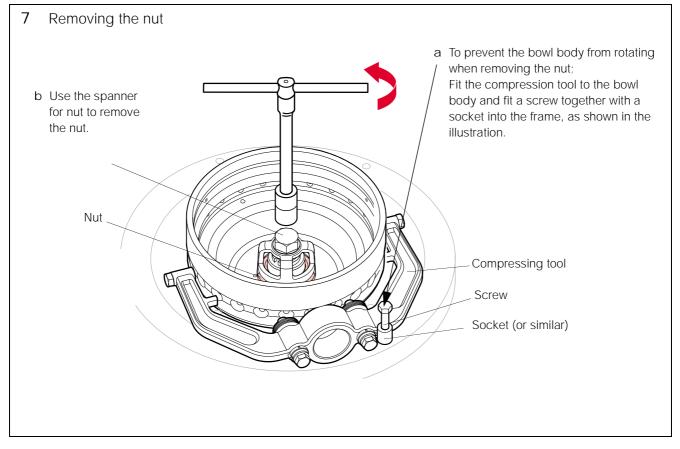


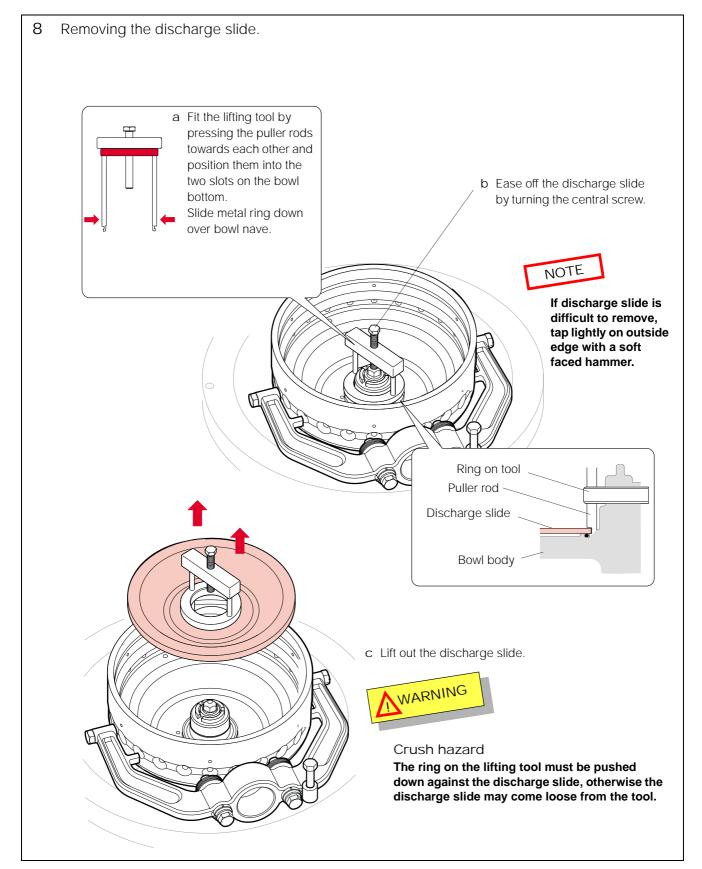


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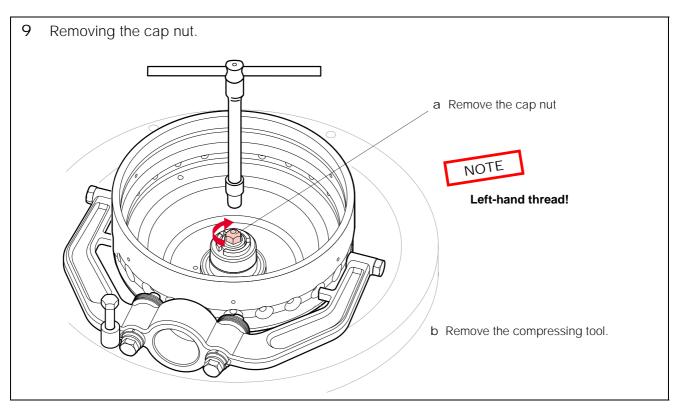
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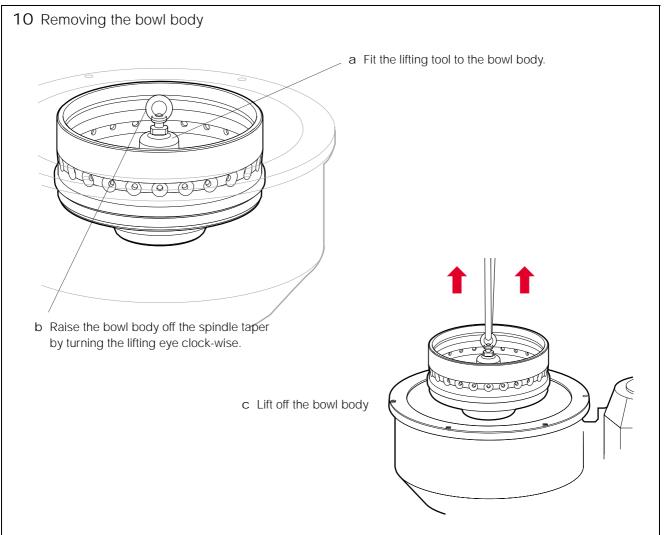


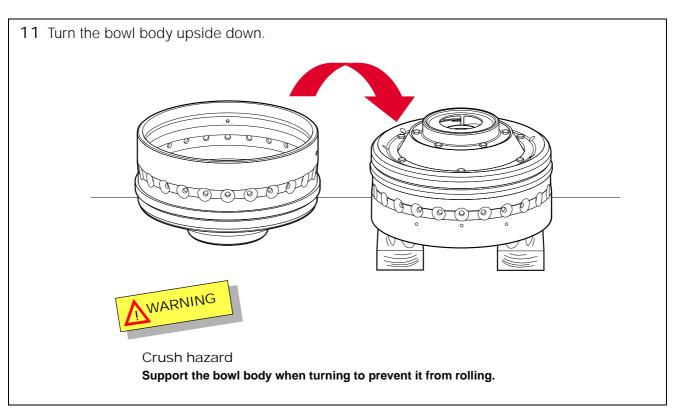


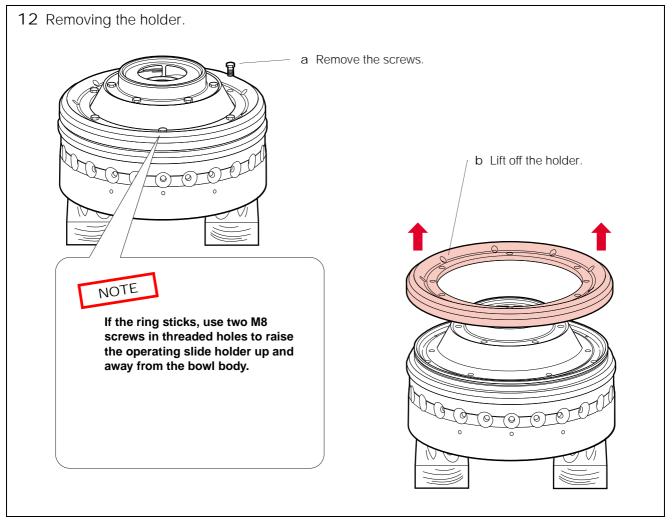


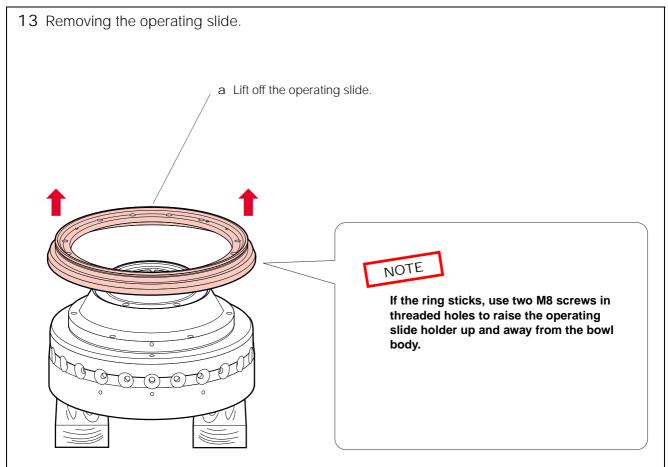
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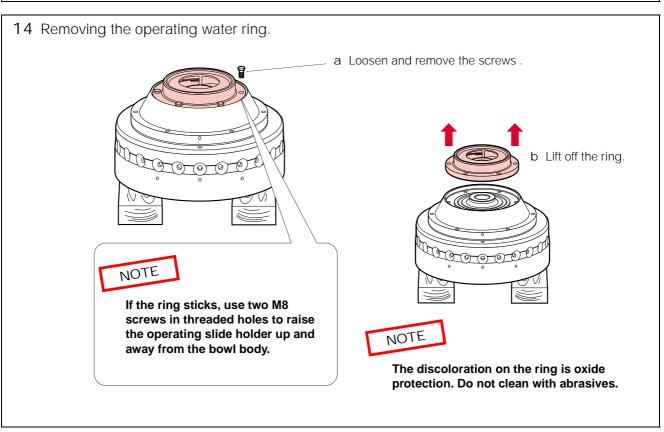




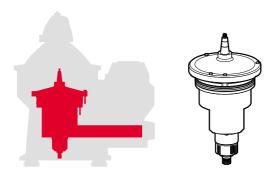


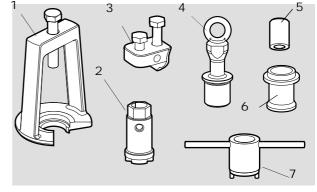






3.3.5 Driving device





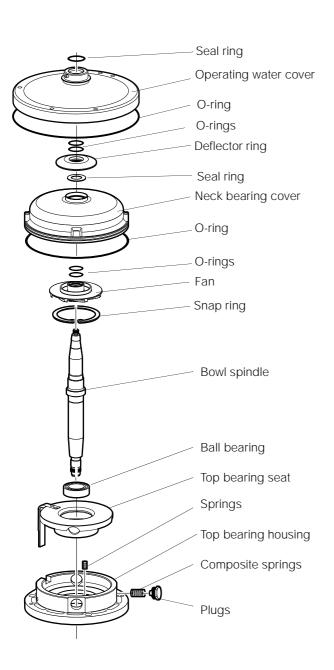
1 Puller (spindle pulley, ball bearing).

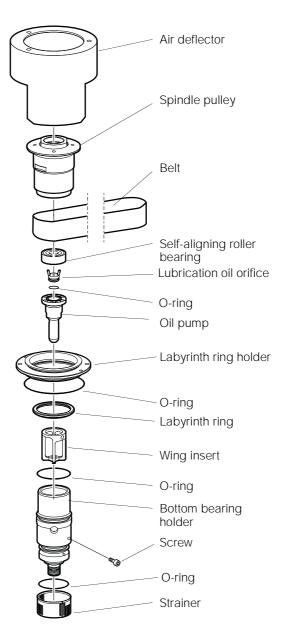
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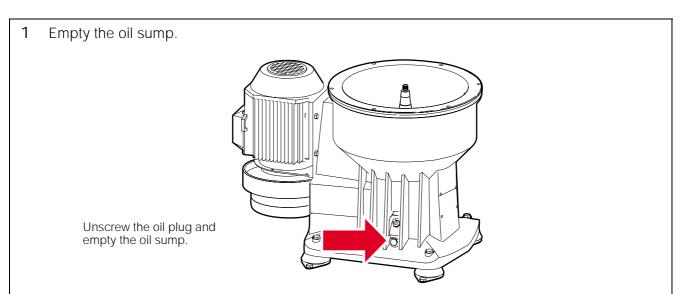
- 2 Tool (bearing housing).
- 3 Cover puller (neck bearing cover).
- 4 Lifting tool (spindle assembly)
- 5 Drift (bottom bearing).

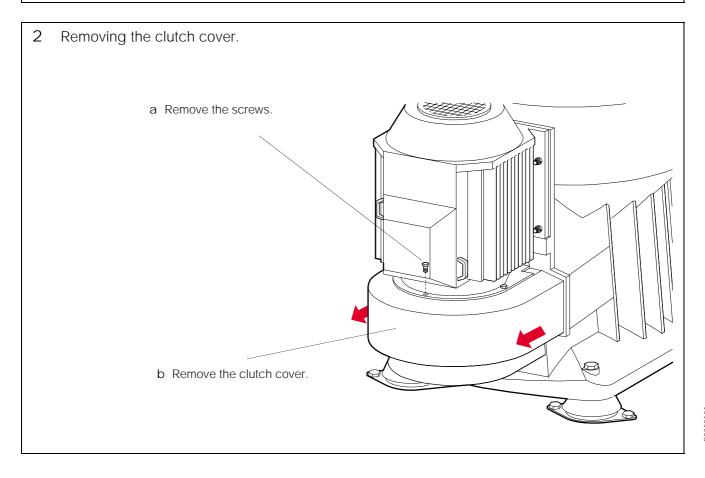
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- 6 Sleeve (ball bearing in top bearing seat
- 7 Pin spanner (oil fan).





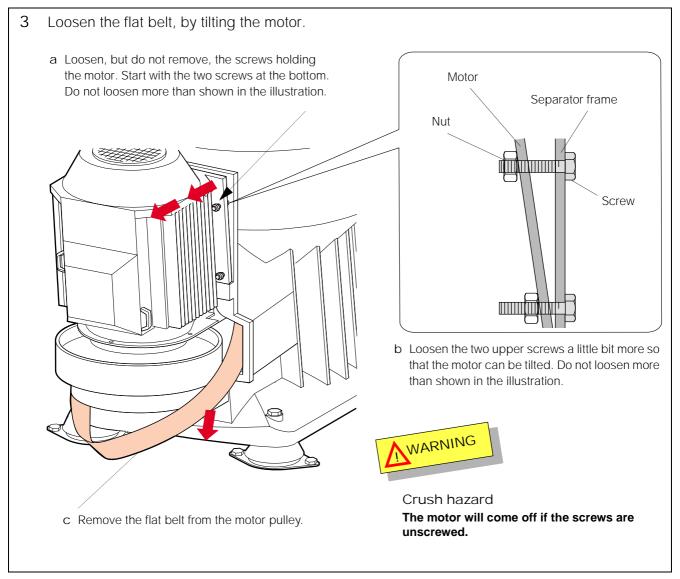


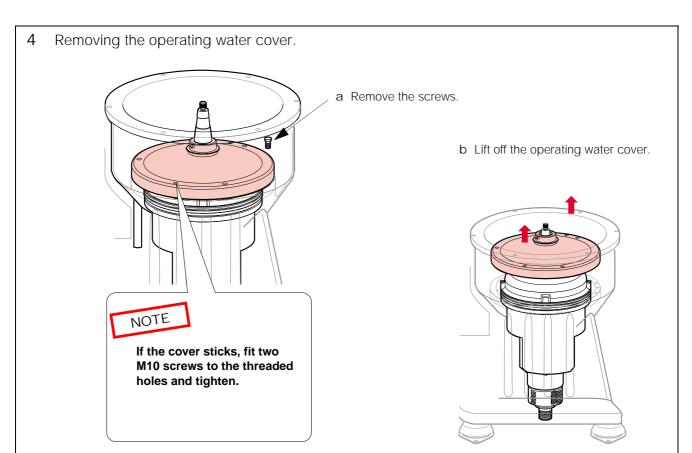


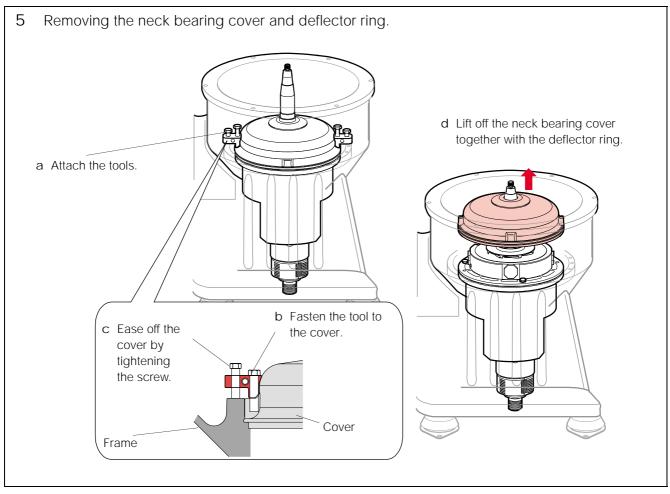
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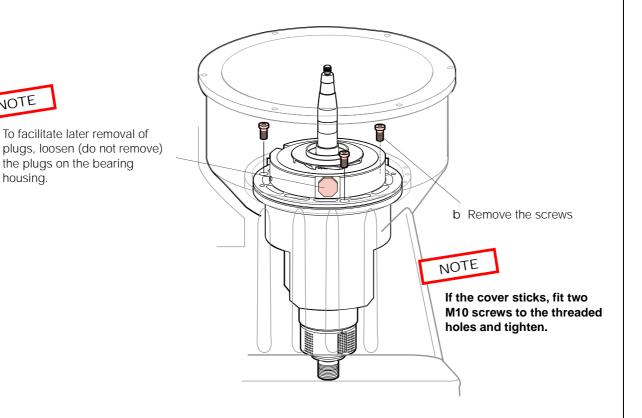


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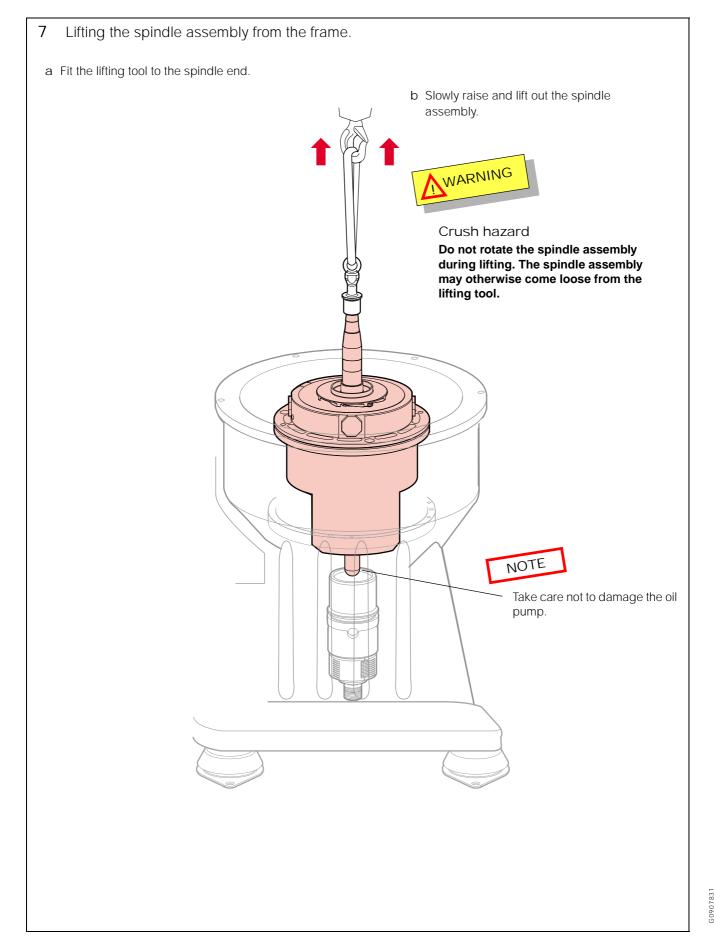
housing.

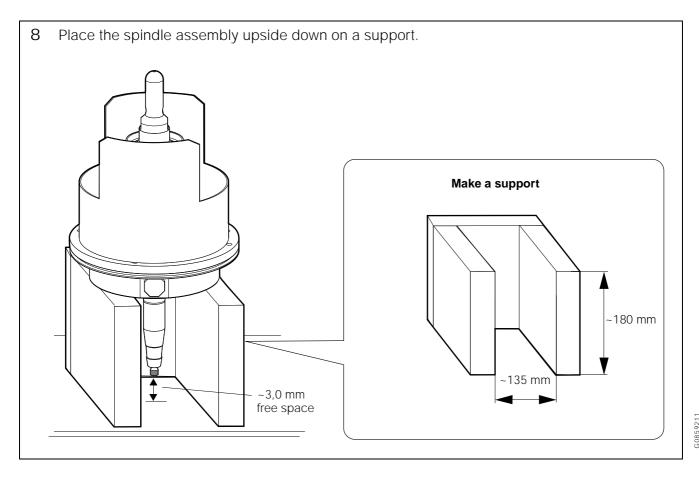
the plugs on the bearing

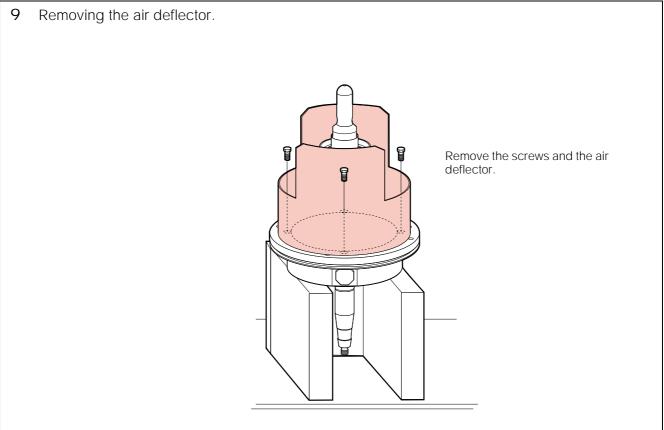
Prepare for removal of spindle assembly.



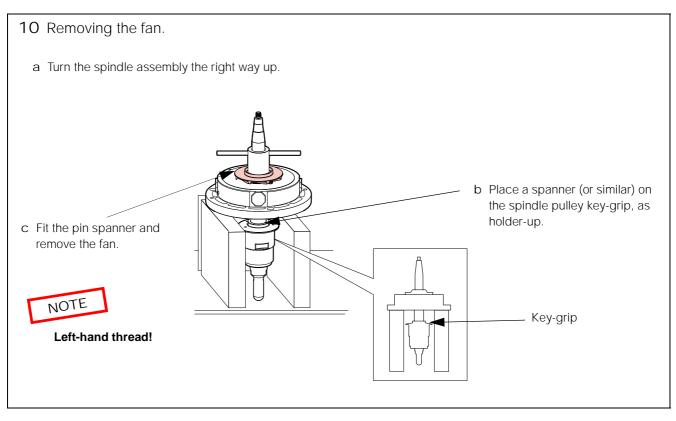
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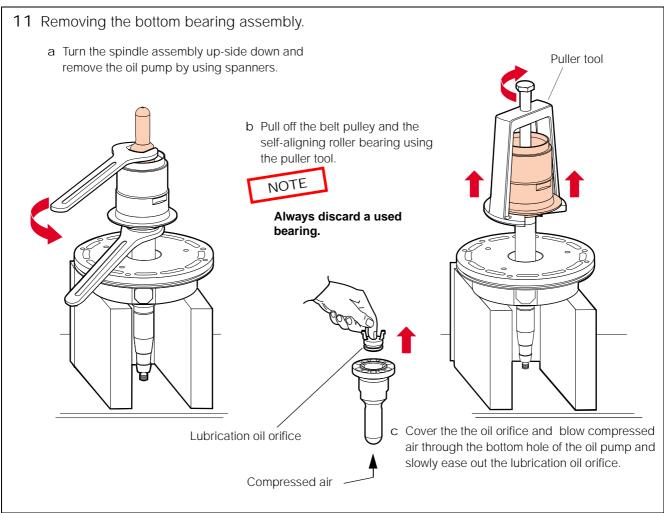




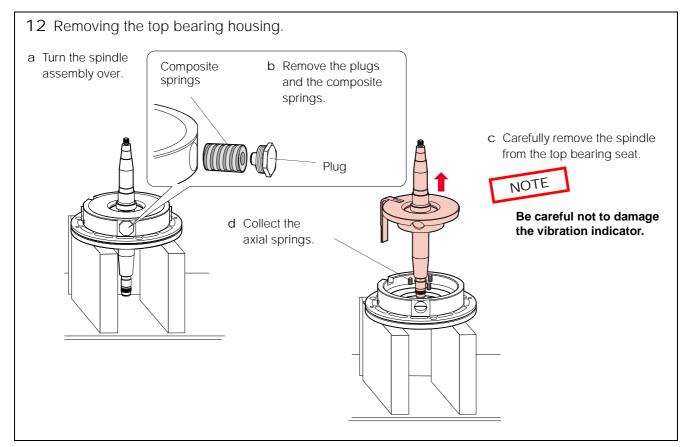


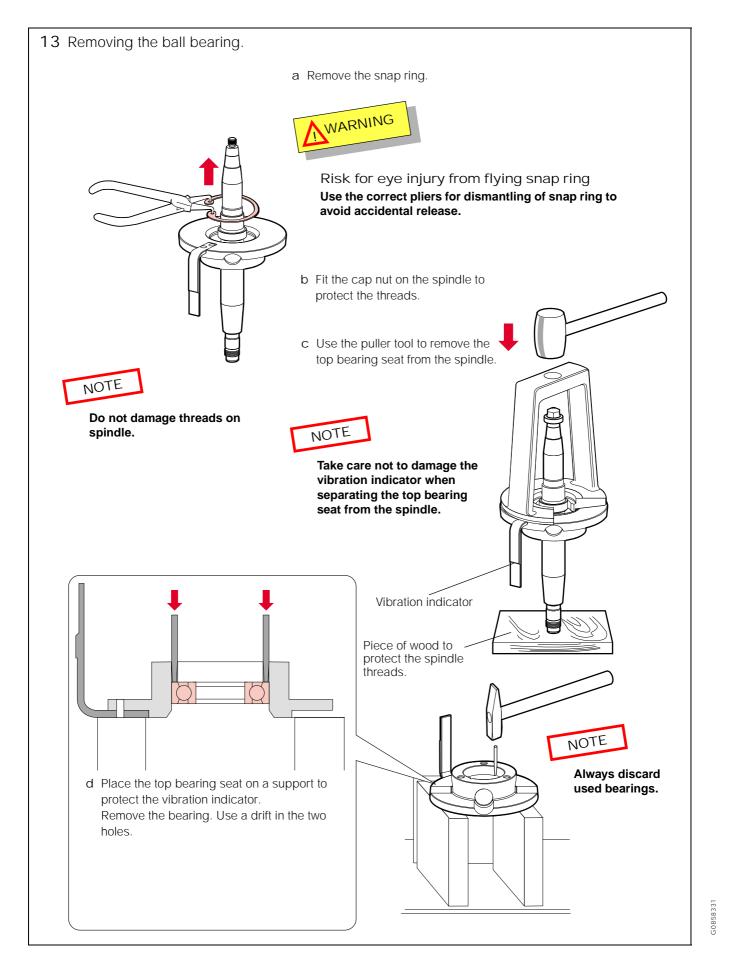
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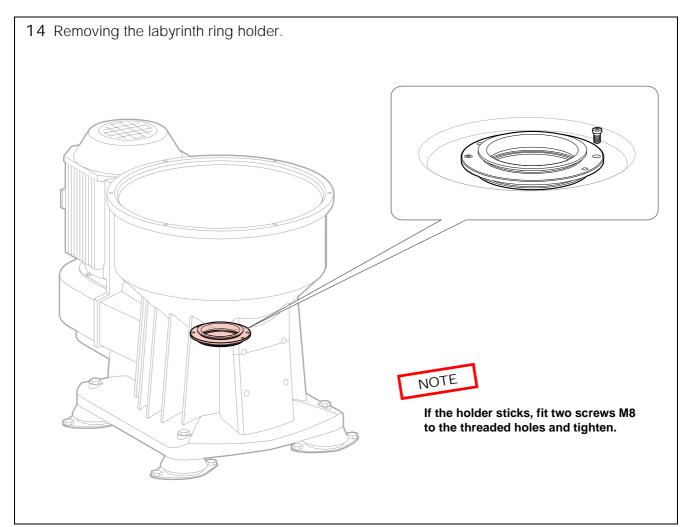


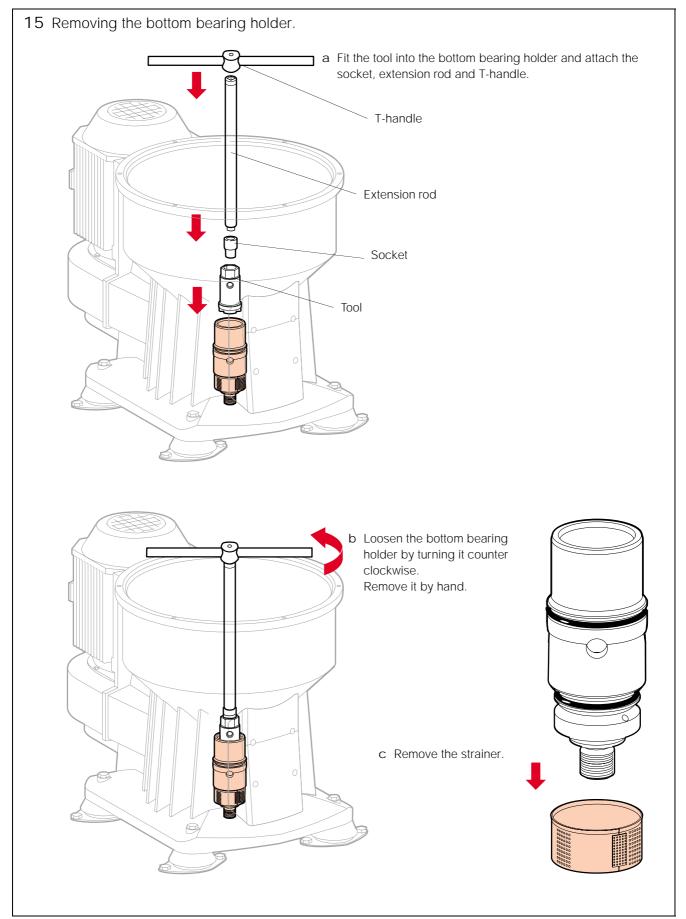




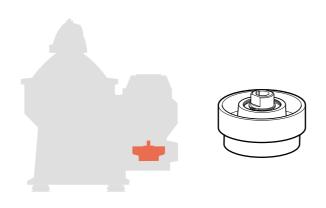








3.3.6 Centrifugal clutch





Entrapment hazard

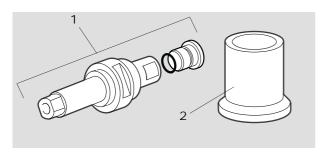
To avoid accidental start, switch off and lock-out power supply before starting any dismantling work.

Make sure that machine has come to a complete standstill before starting any dismantling work (takes about 30 minutes from switch off).

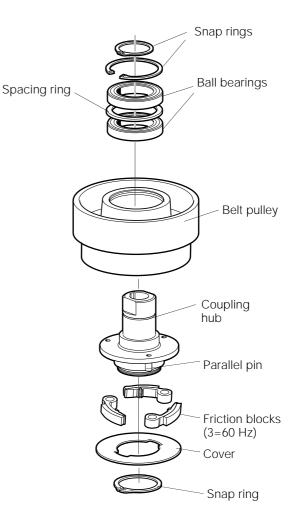


50 Hz = 5 Friction blocks 60 Hz = 3 Friction blocks

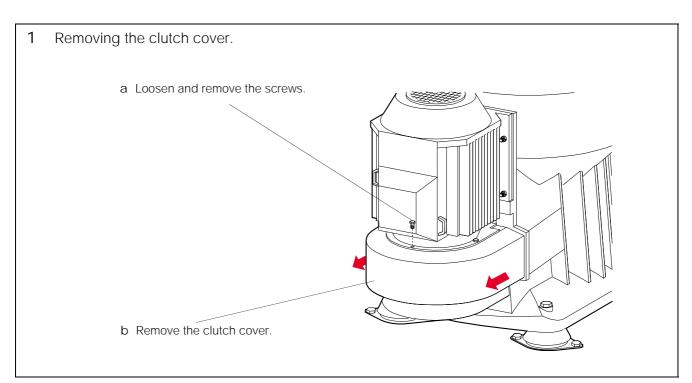
The illustration shows 60 Hz

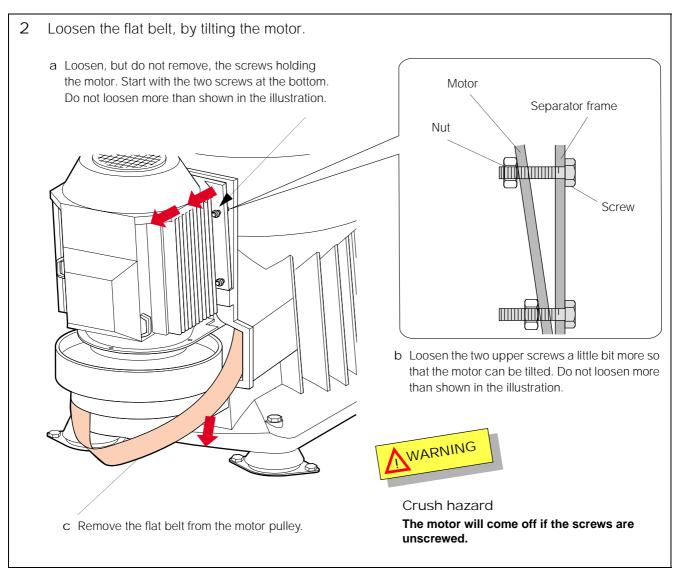


- 1 Mounting /dismantling tool (centrifugal clutch).
- 2 Mounting /dismantling tool (ball bearing).



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a Disconnect the electrical cables.



Electrical hazard

If the cables are not disconnected during lifting procedures, they may become damaged.

b Fit a sling to the motor using a shackle on the upper part.
Weight of motor with coupling: approx. 80 kg.

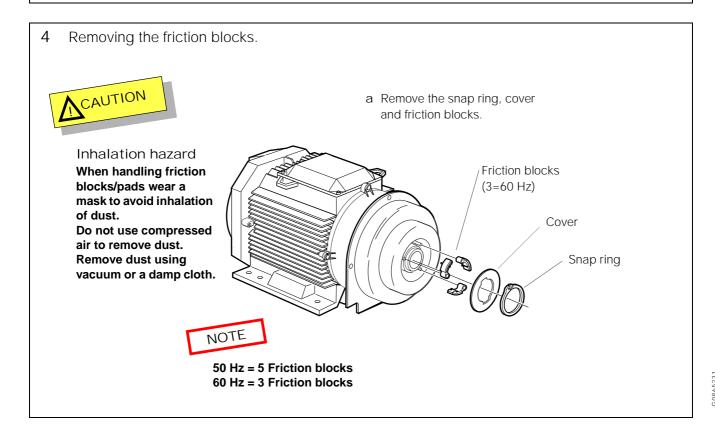
c Tense the lifting sling to support the motor and remove the screws. Lift the motor while supported.



Crush hazard

If not supported, the motor with coupling will drop when removing the screws.

d Lower the motor onto a suitable pallet.





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Inhalation hazard

When handling friction blocks/pads wear a mask to avoid inhalation of dust. Do not use compressed air to remove dust. Remove dust using vacuum or a damp cloth.

If the blocks are worn:

Fit new friction blocks.

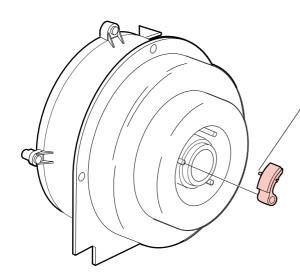


Replace all blocks, even if only one is worn.

a Clean the pins of coupling hub and apply a thin film of lubricating paste to the pins.



Make sure that there is no oil on the pads.



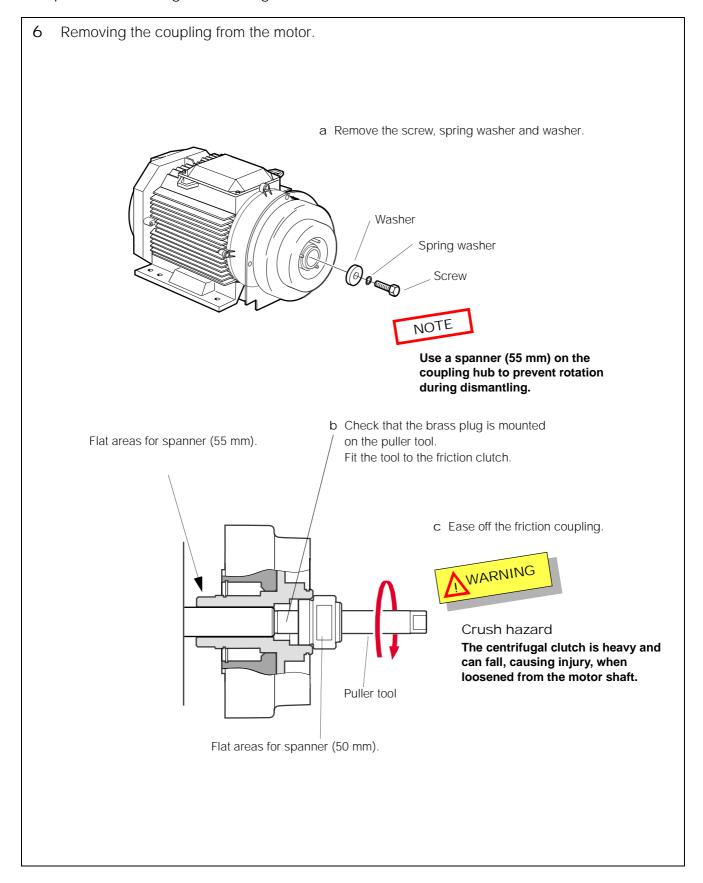
NOTE

Be sure that the pins on the back of the blocks project into the grooves in the clutch hub.

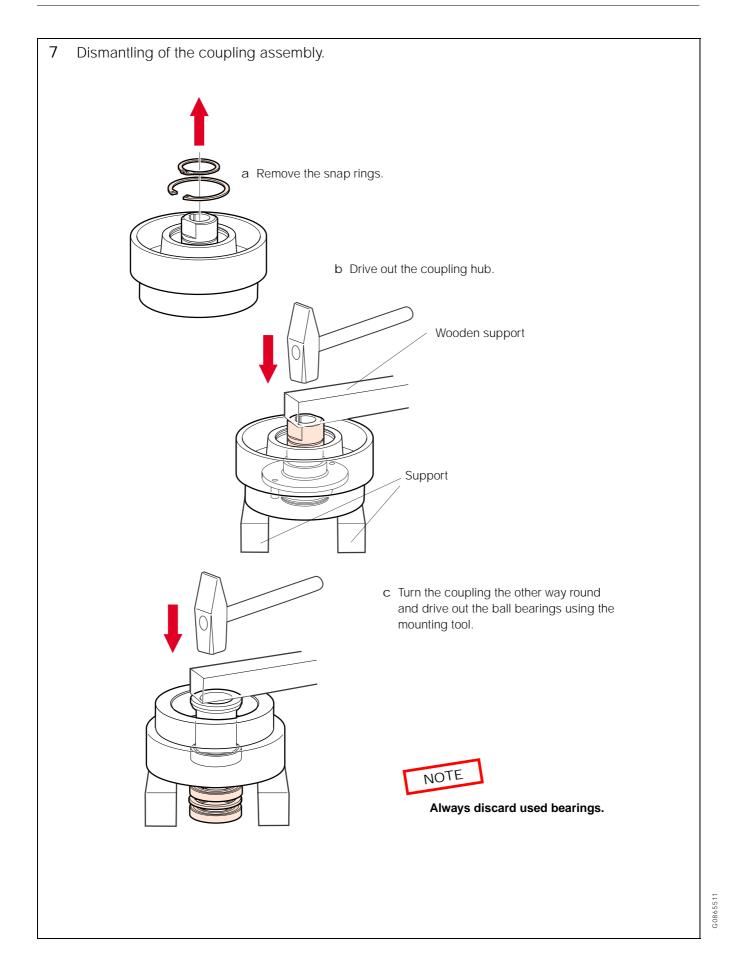
b If only friction block service is to be done, proceed to "Assembly of friction blocks" on page 86.

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Complete dismantling of centrifugal clutch



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3.4 Actions Before Assembly

3.4.1 Cleaning D





Clean the separator parts according to the diagram below. Afterwards, protect all cleaned carbon steel parts against corrosion by oiling.

Part	Procedure	Cleaning agents
Frame and motor	The external cleaning of the frame and motor should be restricted to brushing, sponging or wiping while the motor is running or still is hot.	Water and de-greasing agent.
	Electrical hazard Never wash down a separator with a direct water stream. Never play a water jet on the motor. Totally enclosed motors can be damaged by direct hosing to the same extent as open motors, resulting in short-circuit and internal corrosion.	
	Clean the inside of the frame with a clean cloth and remove visible particles.	

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Part	Procedure	Cleaning agents	
Bowl	Cleaning of bowl discs	A chemical cleaning agent must	
Inlet/ outlet	Handle the bowl discs carefully in order to avoid damage to the surfaces during cleaning	dissolve the deposits quickly without attacking the material of the separator parts.	
	Remove the bowl discs from the distributor and place them individually in the cleaning agent.	Fuel oil sludge mainly consists of complex organic substances such as asphaltenes. The most important property of a cleaning liquid for the removal of fuel oil sludge is the ability to dissolve these asphaltenes.	
	Allow the discs to remain in the cleaning agent until the deposits have been dissolved. This will normally take between two and four hours.		
	3 Lastly, clean the discs with a soft brush.		
	Cleaning of holder for operating slide, operating water ring and operating slide with nozzle.	A CAUTION	
	Use 10% acetic acid solution to dissolve lime deposits. The acid should be heated to 80 °C.	Cut hazard	
	Clean the nozzle on the operating slide using a soft iron wire or a similar object.	Sharp edges on the separator discs may cause cuts.	
Driving device	Use a sponge or a soft brush and clean the oil orifice, bearing holder and oil pump thoroughly.	White spirit, cleaning-grade kerosene or diesel oil.	
Centrifugal clutch	Use a sponge or a soft brush.	White spirit, cleaning-grade kerosene or diesel oil.	
Belt pulley	Use a a steel brush.	Solvent	

3.4.2 Inspection for corrosion

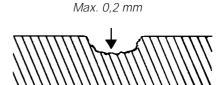


Inspect the separator parts for corrosion. Evidence of corrosion attacks should be looked for and rectified each time the separator is dismantled.



Disintegration hazards

Always contact your Alfa Laval representative if you suspect that the depth of the corrosion damage exceeds 0,2 mm for bowl body and bowl hood (0,5 for other parts) or if cracks have been found. Do not continue to use the separator until it has been inspected and given clearance for operation by Alfa Laval.



Material	Type of corrosive environment	Appearance	Measure
Non-stainless steel and cast iron parts	Water or dampness	Rust	If damage exceeds 0,5 mm, contact Alfa Laval.
Stainless steel	Chlorides or acidic solutions	Acidic solutions cause general corrosion. Chloride corrosion begins as small dark spots that can be difficult to detect, and goes on to local damage such as pitting, grooves or cracks.	Polish dark-coloured spots and other corrosion marks with a fine grain emery cloth. This may prevent further damage. If damage exceeds 0,5 mm (0,2 mm for bowl body and bowl hood) contact Alfa Laval.
Other metal parts	"Aggressive" environment	Possible corrosion damage can be in the form of pits and/or cracks.	If damage exceeds 0,5 mm, contact Alfa Laval.



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Disintegration hazard

Pits and spots forming a line may indicate cracks beneath the surface.

All forms of cracks are a potential danger and are totally unacceptable.

Replace any part where corrosion can be suspected of affecting its strength or function.

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3.4.3 Inspection for cracks





Check the separator parts for cracks. It is particularly important to inspect for cracks in rotating parts, and especially the pillars between the sludge ports in the bowl wall.



Disintegration hazard

All forms of cracks are potentially dangerous as they reduce the strength and functional ability of components.

Always replace a part if cracks are present.

Cracks can occur from cyclic material stresses and corrosion. Keeping the separator and its parts clean and free from deposits will help to prevent corrosion attacks.



Disintegration hazards

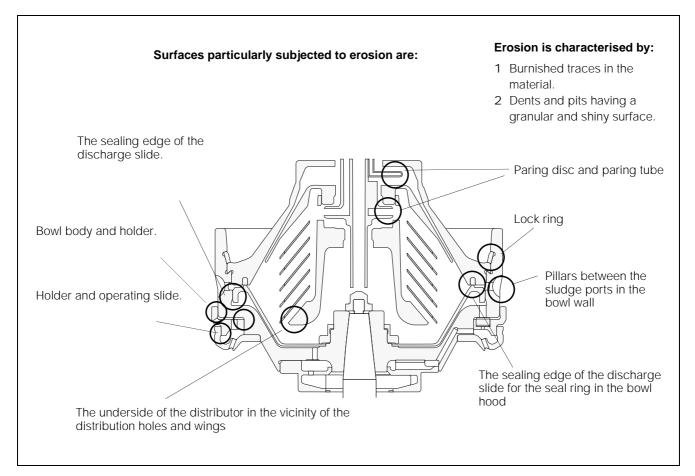
Always contact your Alfa Laval representative if you suspect that the depth of the damage exceeds 0,2 mm for bowl body and bowl hood (0,5 for other

Do not continue to use the separator until it has been inspected and given clearance for operation by Alfa Laval.

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3.4.4 Inspection for erosion i

Erosion may occur when particles suspended in the process liquid slide along or strike against a surface.



1 Inspect the bowl and inlet/outlet parts for erosion damages.



Always contact your Alfa Laval representative if you suspect that the depth of the damage exceeds 0,2 mm for bowl body and bowl hood (0,5 for other parts). Do not continue to use the separator until it has been inspected and cleared for operation by Alfa Laval.

2 Replace parts if erosion is suspected.



Disintegration hazard

Erosion damage weakens parts by reducing the thickness of the material.

Pay special attention to the pillars between the sludge ports in the bowl wall.

Replace parts if erosion is suspected of affecting strength or function.

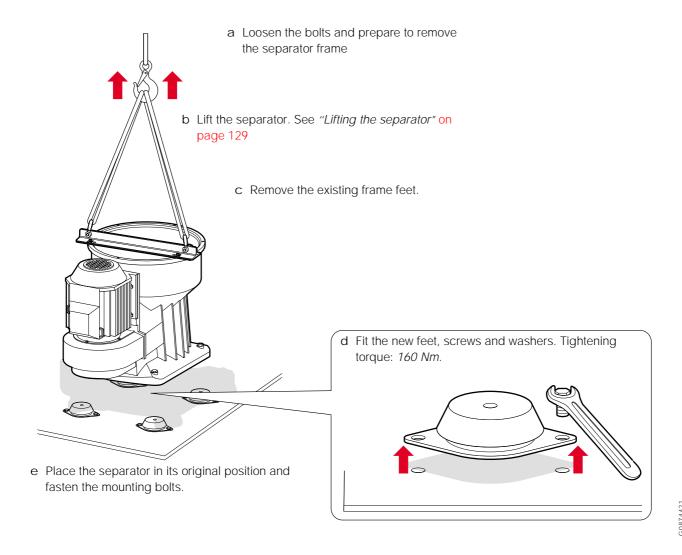
3.4.5 Exchange of frame feet

The frame feet have to be changed occasionally due to rubber deterioration from age.

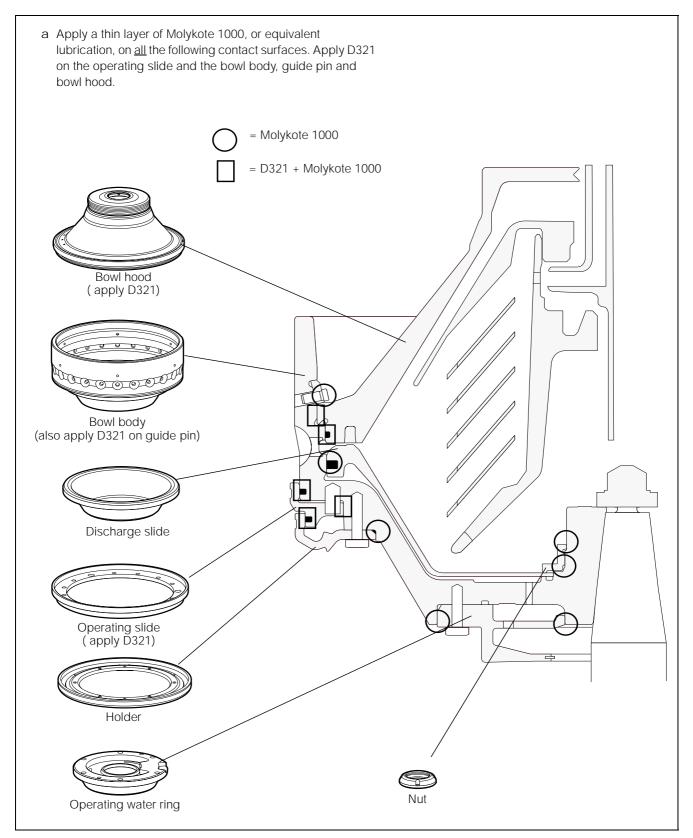
When replacing the frame feet, the separator must be lifted. Follow 3.8.1 Lifting the separator, page 129.



Discard the old frame feet, screws and washers.



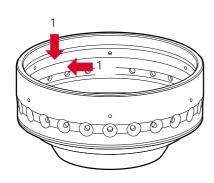
3.4.6 Lubrication of bowl parts



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3.4.7 How to lubricate bowl parts with slide laquer





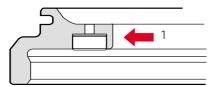


This instruction is also valid for the operating slide and the holder.

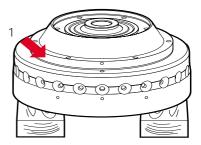
- a Carefully clean the contact surfaces (1) on bowl body and bowl hood.
- b Apply Molykote D321R on surfaces.
- c Air-cure for 15 minutes.
- d Use a smooth fibre brush to polish to an even and homogenous contact film.
- e Apply a second layer slide laquer.
- f Air-cure for 15 minutes.
- g Polish the film to a shiny surface, the film should look like well-polished leather when properly done.
- h Finish the treatment by lubricating the contact surfaces with Alfa Laval lubricating paste or Molykote 1000 paste. Use a well cleaned brush and rub it into the surface, do not leave any excessive paste.

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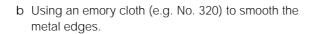
3.4.8 Check for galling on operating slide and bowl body

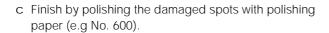


If any friction marks are found on the guide surfaces (1) of operating slide and bowl body, proceed as follows:



a Clean the surface thoroughly with a degreasing agent, i.e. white spirit.This is important!





d Apply Molykote D321R on surfaces.

- e Air-cure for 15 minutes.
- f Polish to an even, homogenous surface.
- g Apply a second layer.
- h Air-cure for 15 minutes.
- i Polish to a shiny surface, the surface should look like well-polished leather when properly done.
- j Finish the treatment by lubricating the guiding surfaces with Alfa Laval lubricating paste or Molykote 1000 paste. Use a well cleaned brush. Rub it into the surface, do not leave any excessive paste.



To avoid the risk of galling, the guiding surface of the operating slide should be primed with a slide lacquer at every inspection service.

3.5 Assembly

3.5.1 Centrifugal clutch

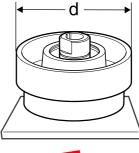
- 1 Assembly of the coupling.
 - a Slip the belt pulley over the coupling hub and place them on a firm and level foundation.



Disintegration Hazard

If the belt pulley must be renewed, check that the new pulley has the correct diameter. An incorrect pulley will cause the separator bowl to run at either an excessive or insufficient speed.

d=253,5 mm 50 Hz d=211 mm 60 Hz

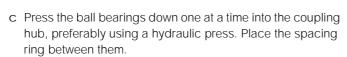




Remove rust from the belt pulley using a steel brush.



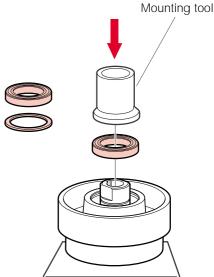
b Apply a thin film of oil onto the external and internal surfaces of the ball bearings .

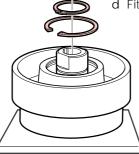




Never re-fit used ball bearings.

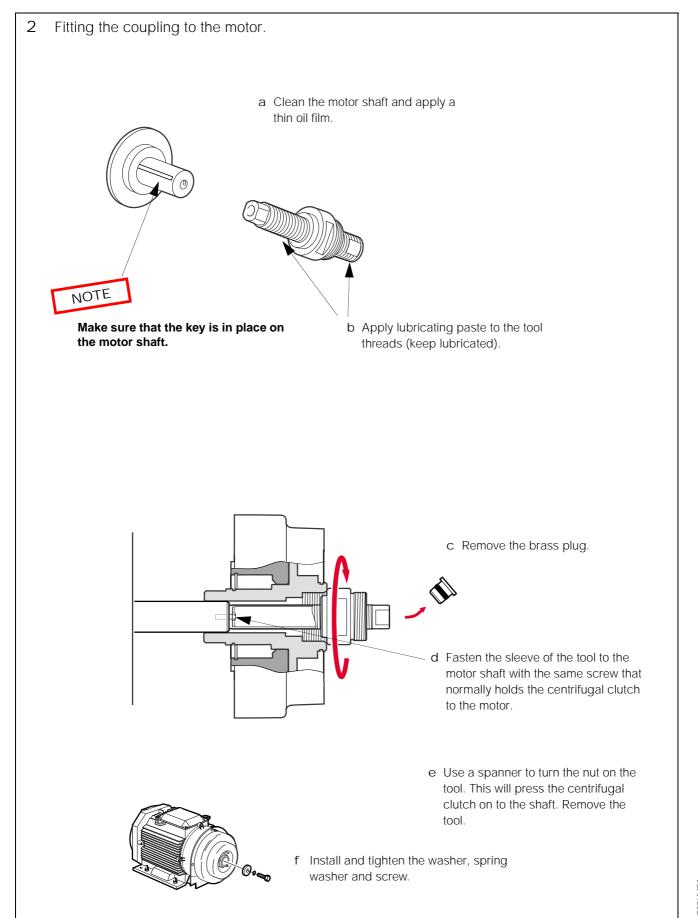
The ball bearings must not be heated as they are packed with grease and sealed with plastic membranes.



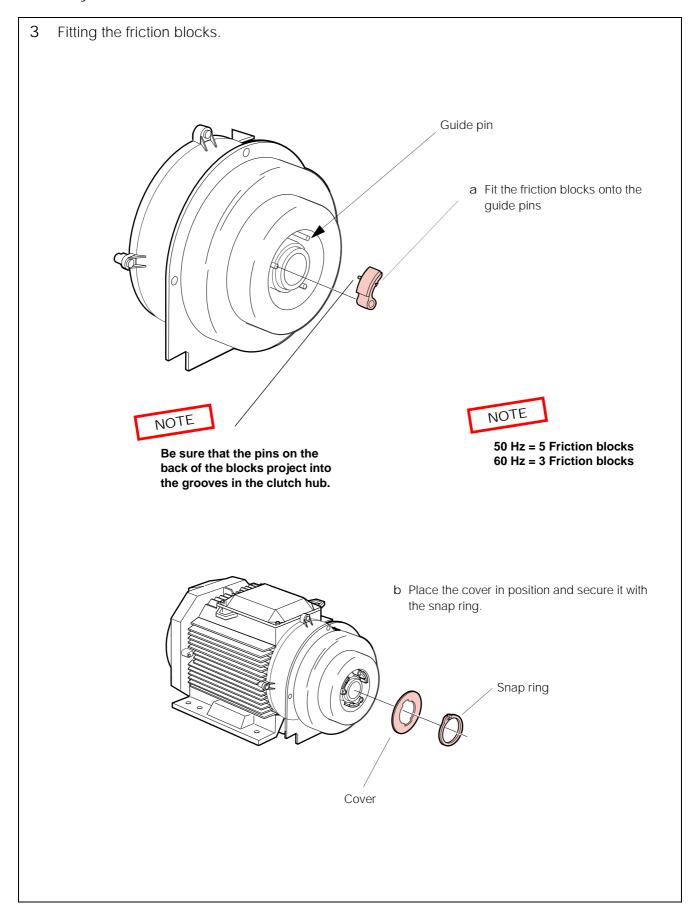


d Fit the snap rings.

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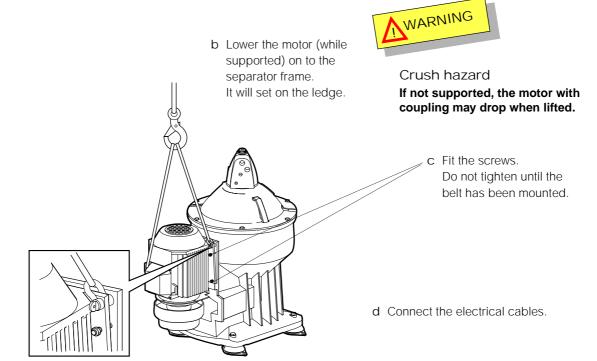
Assembly of friction blocks



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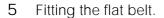
4 Fitting the motor.

a Fit a lifting sling to the motor.
 Use a shackle from the separator lifting tool.
 Weight of motor with coupling: approx. 80 kg.





If carrying out change of friction blocks only, continue with steps 5 to 6.
If carrying out a complete machine assembly, continue with the driving device instructions on page 90.





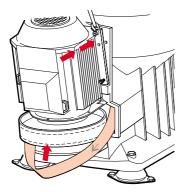
Clean the inside of the frame before fitting the flat belt, and make sure that there is no oil on the belt.

a Lift up the belt to the middle (centre) of the spindle pulley.

NOTE

For correct position, centre the belt on the spindle pulley camber.

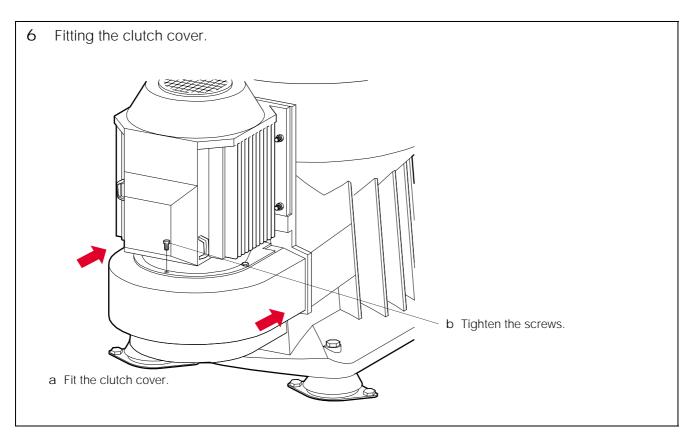
b Fit the flat belt to the motor belt pulley.



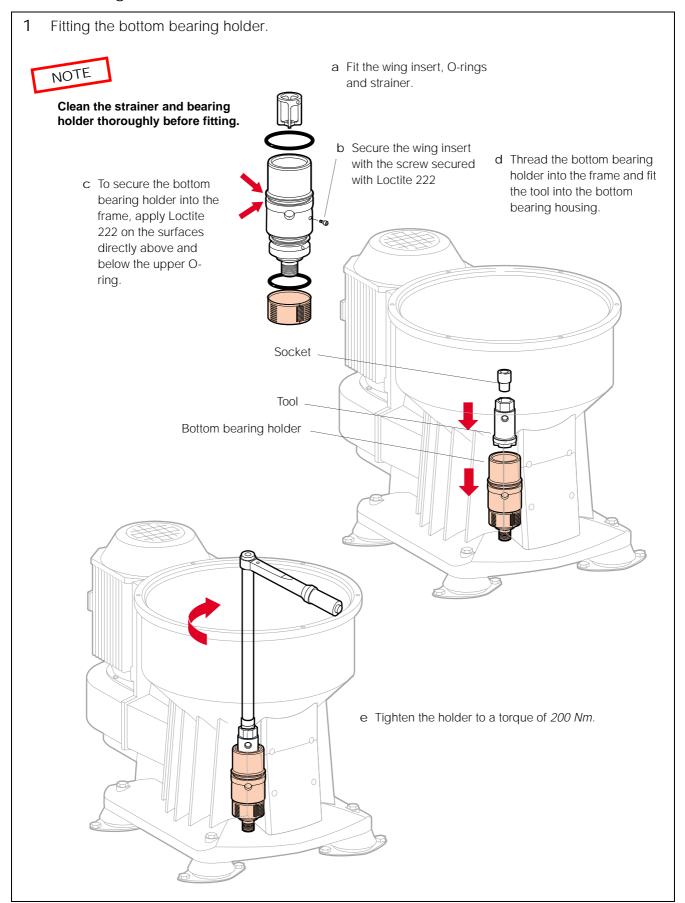
- c Tighten the two upper screws.
 - d Tighten all motor attachment screws.



Do not turn the spindle until the motor is tightened properly to the frame.

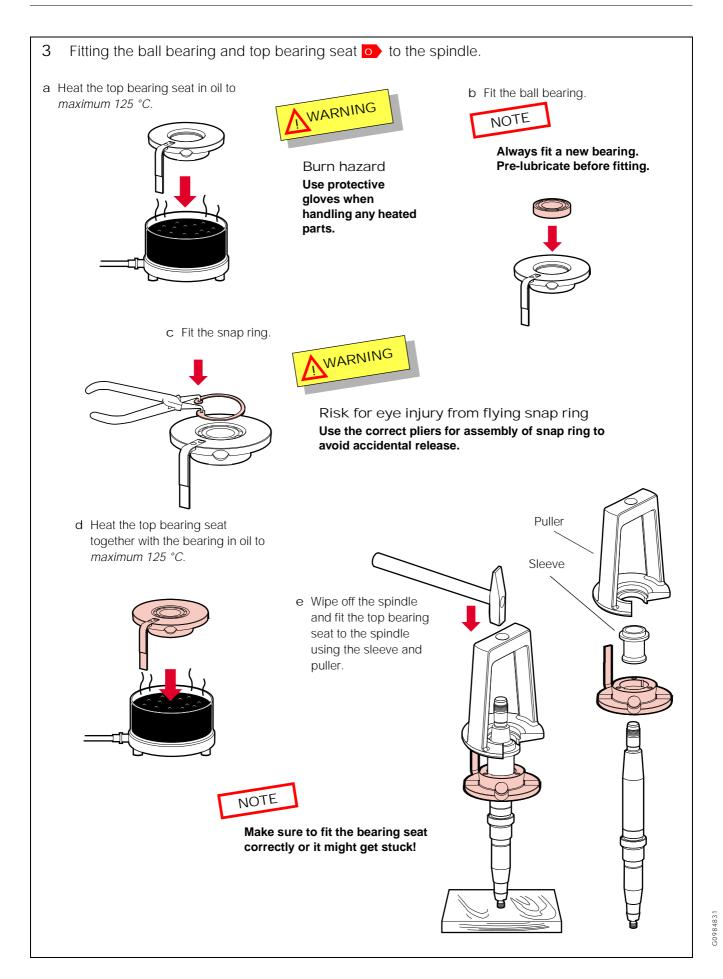


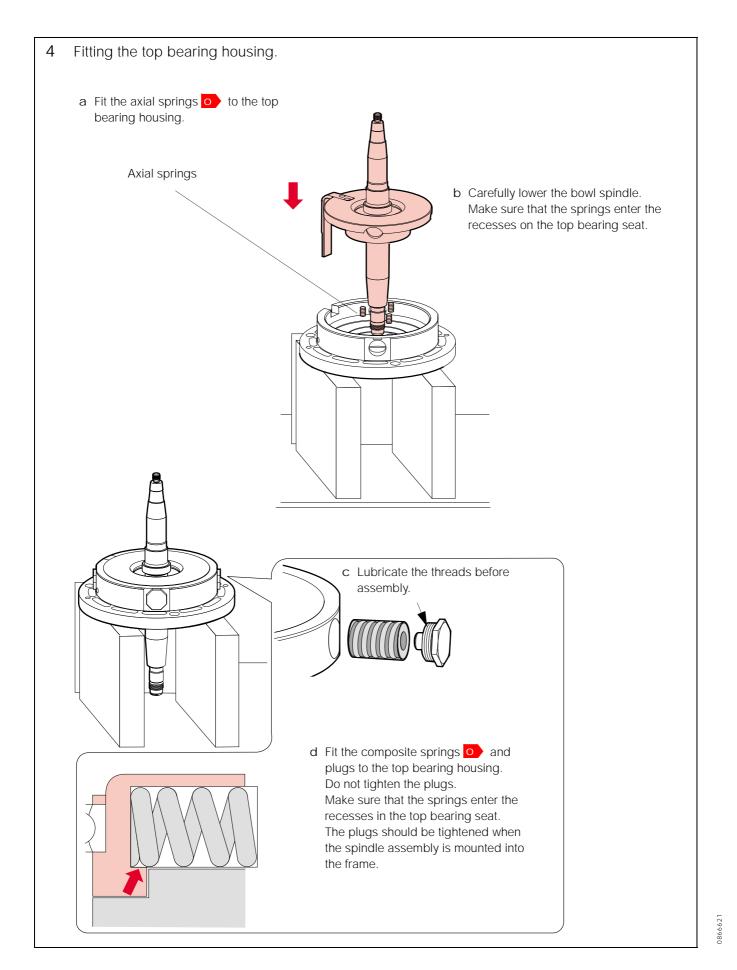
3.5.2 Driving device



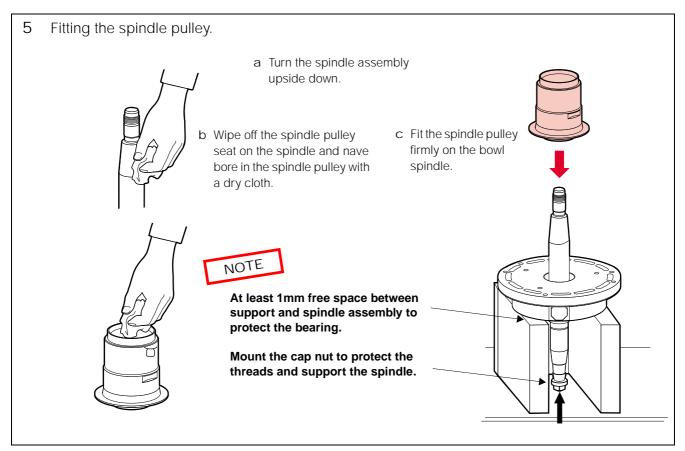
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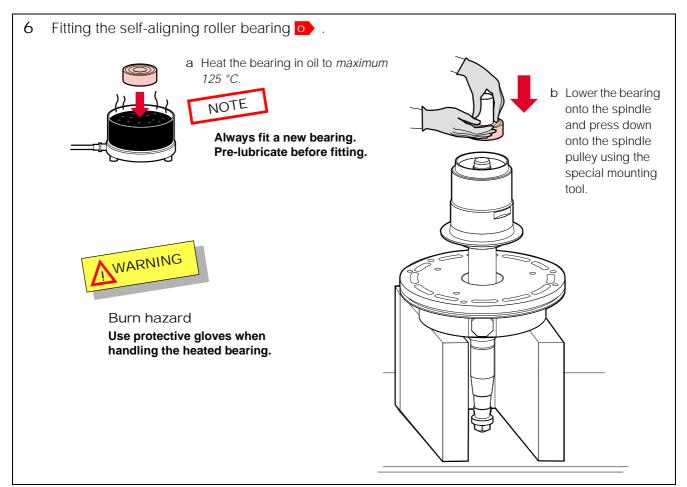
91

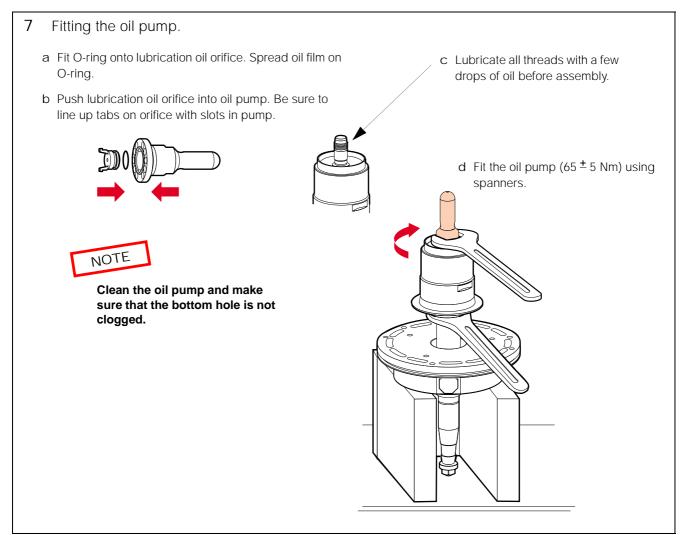


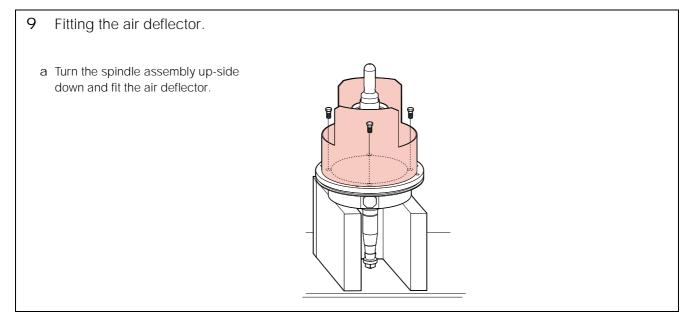






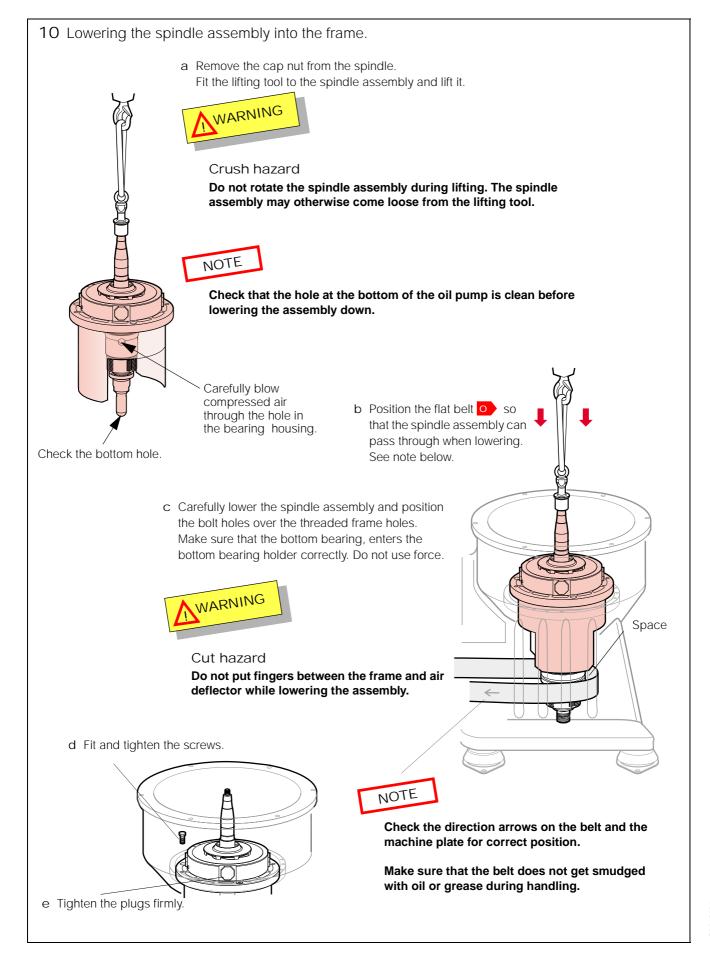






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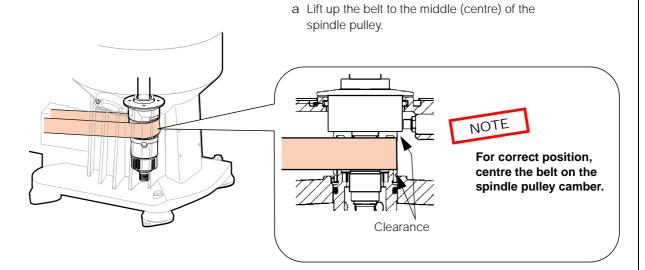
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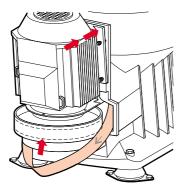
11 Fitting the flat belt.



Clean the inside of the frame before fitting the flat belt, and make sure that there is no oil on the belt.



b Fit the flat belt to the motor belt pulley.



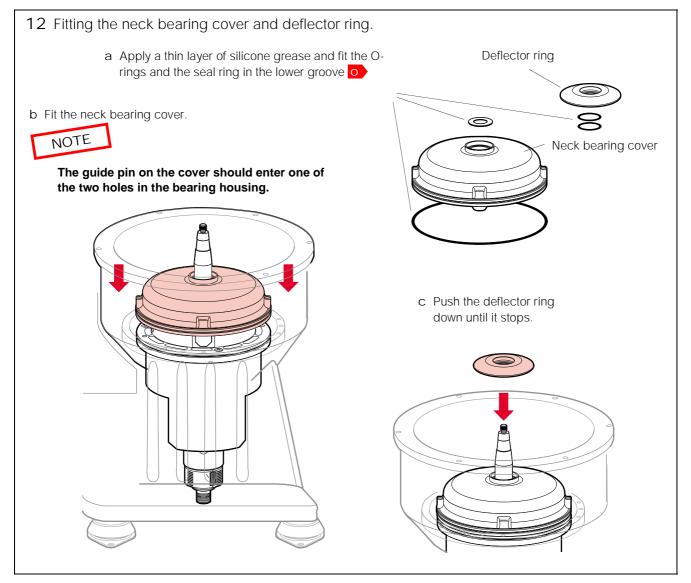
- c Tighten the two upper screws.
 - d Tighten all motor attachment screws.

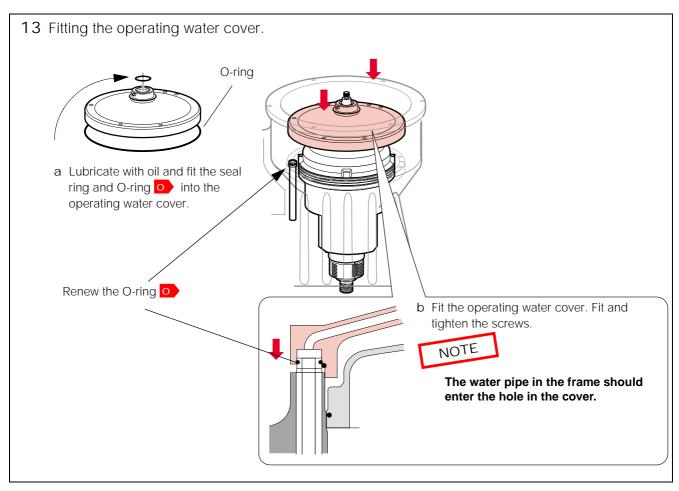


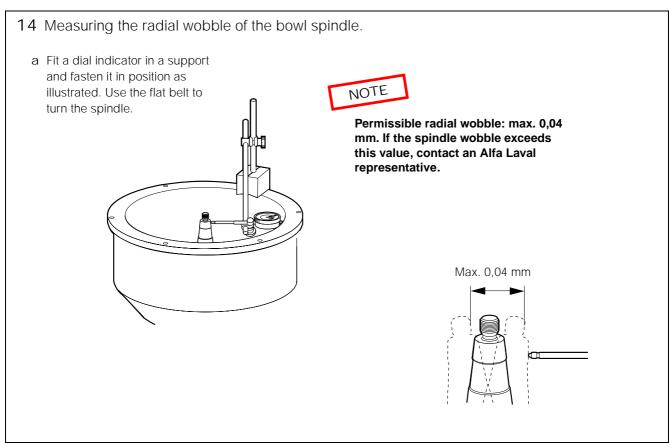
Do not turn the spindle until the motor is tightened properly to the frame.

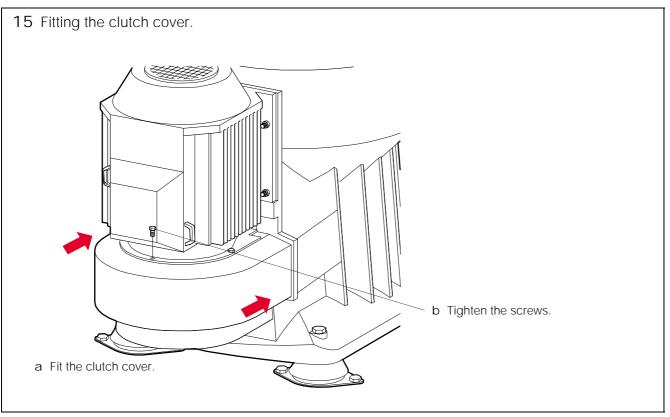
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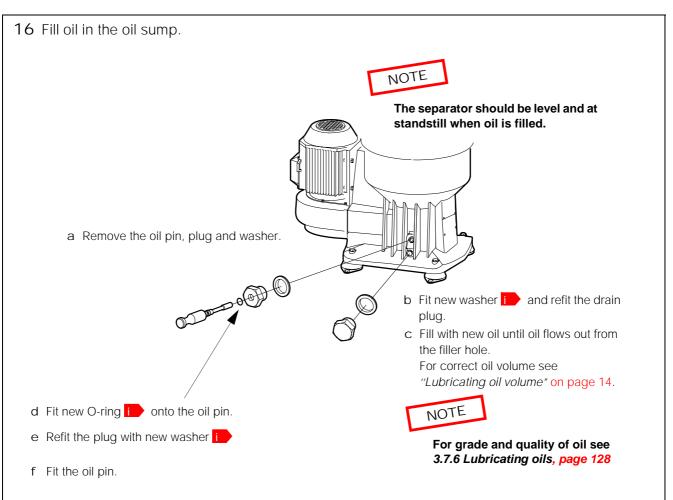












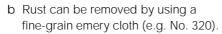
3.5.3 Bowl

1 Check for impact marks and corrosion in bowl body nave and on spindle taper .



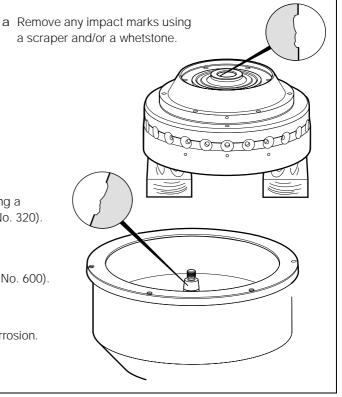
Disintegration hazard

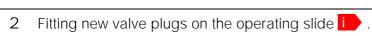
Impact marks may cause the separator to vibrate while running.

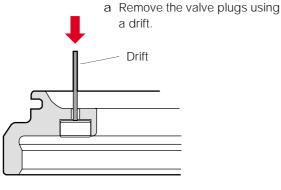


c Finish with polishing paper (e.g. No. 600).





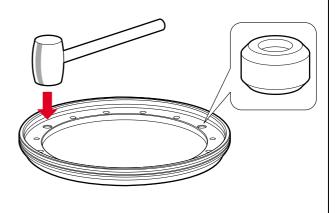




b Carefully tap in new valve plugs, using a clean, soft-faced hammer.

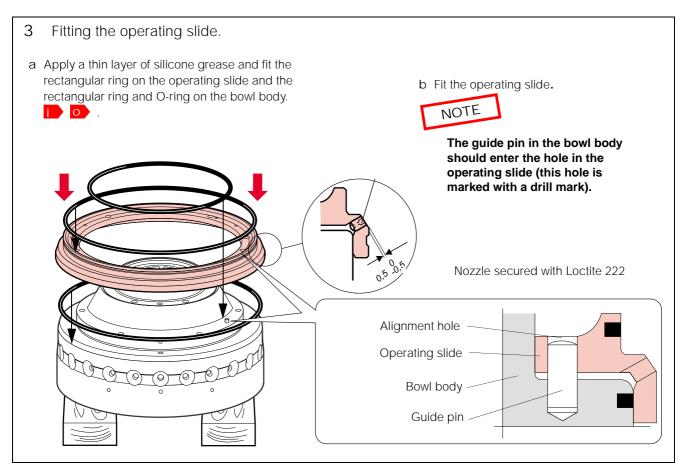


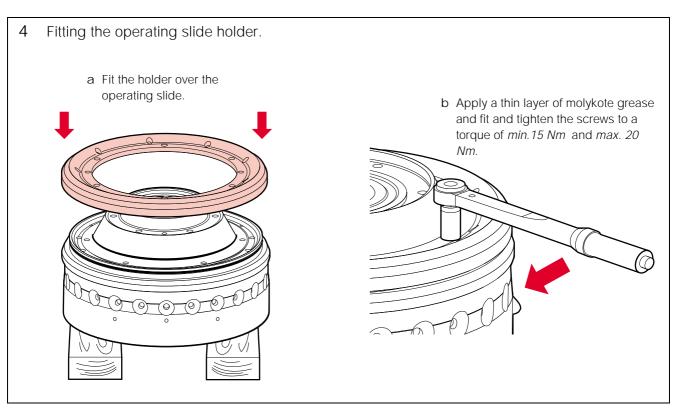
Make sure that the plugs are fitted as described in the illustration.



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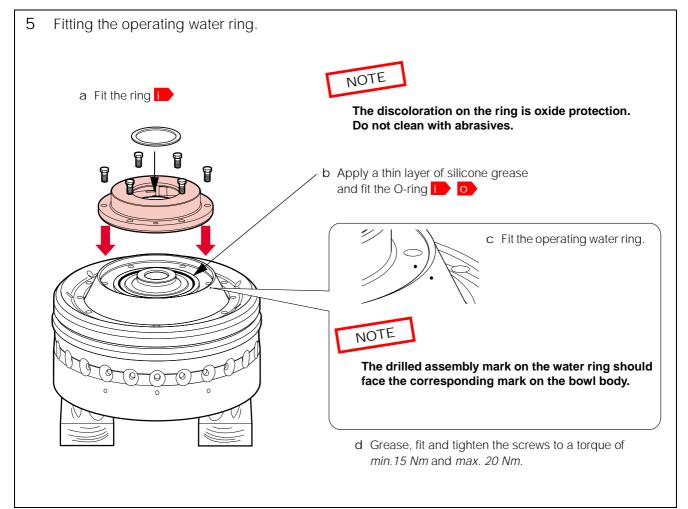
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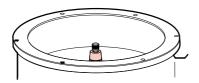


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- 6 Lifting the bowl body onto the spindle taper.
 - a Put a drop of oil on the spindle taper.

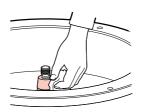


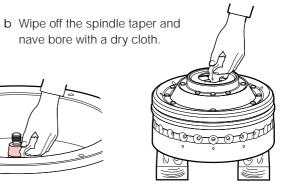
c Turn the bowl body over.

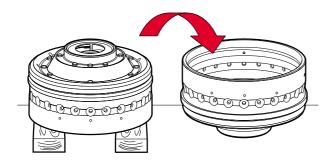


Crush hazard

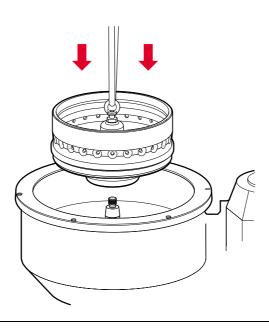
Support the bowl body when turning to prevent it from rolling.

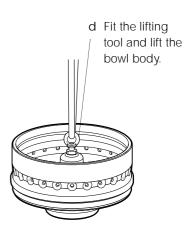






e Carefully lower the bowl body onto the spindle taper.





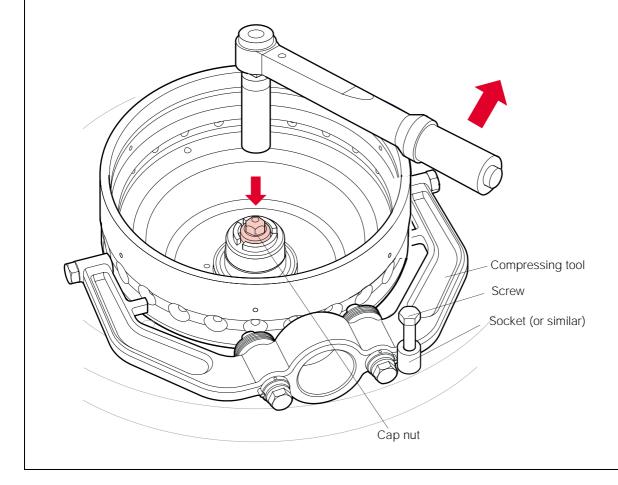
f Remove the lifting tool.



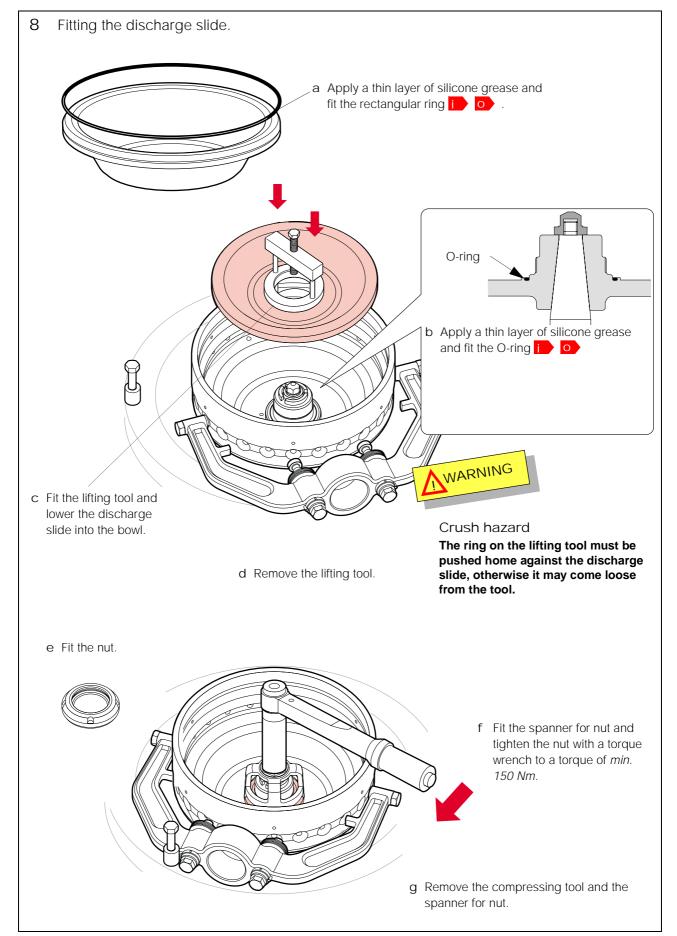
- a To prevent the bowl body from rotating when fitting the cap nut;
 Fit the compressing tool to the bowl body and fit a screw together with a socket into the frame, as shown in the illustration.
- b Apply a thin layer of molykote grease. Fit and tighten the cap nut to a torque of 50 Nm.

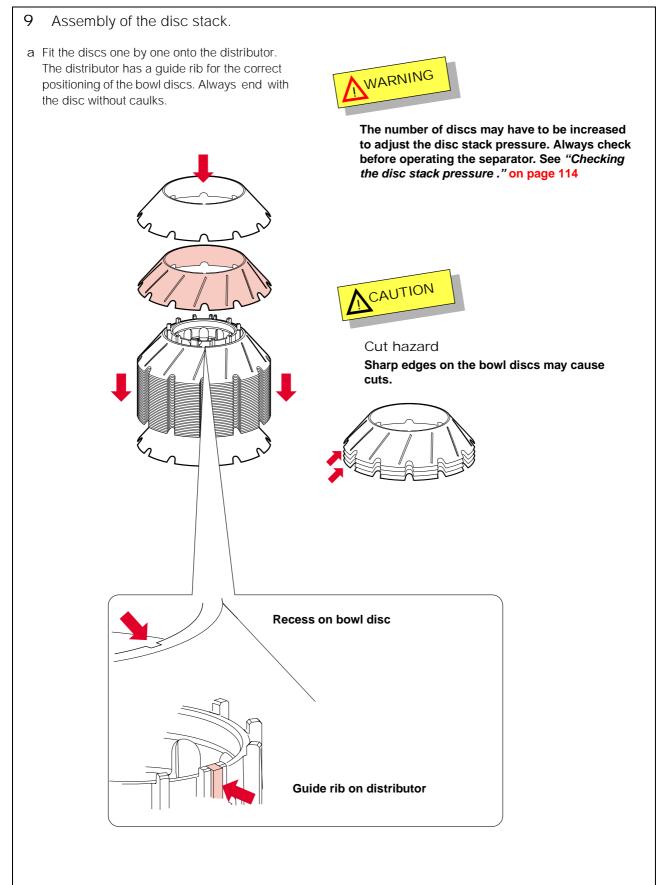


Left-hand thread!

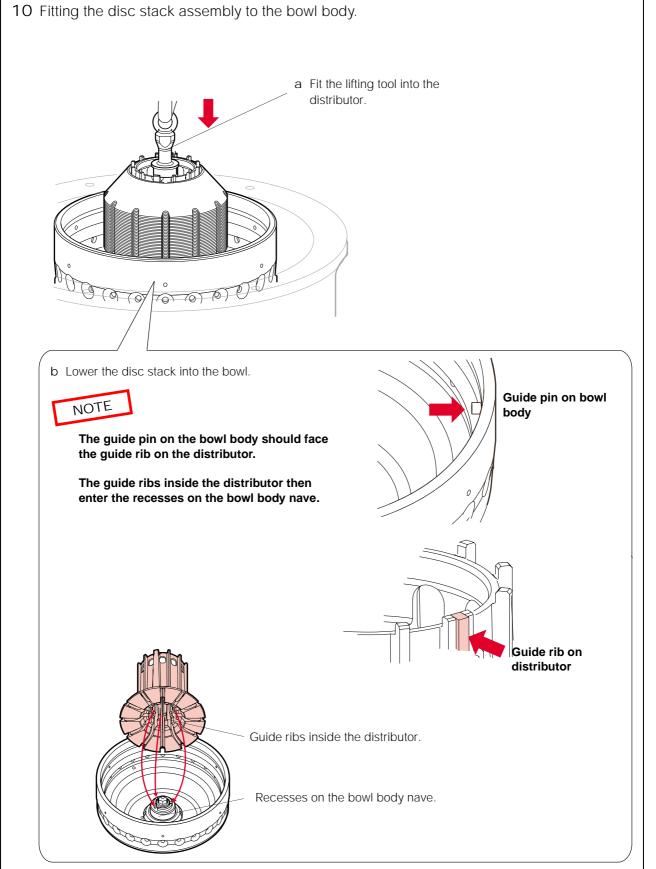


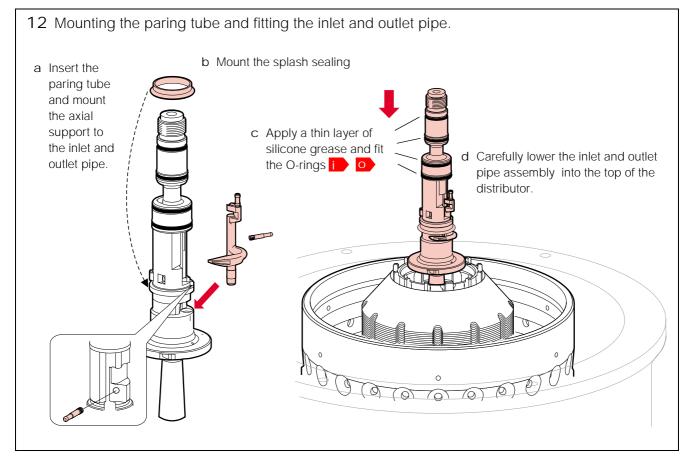
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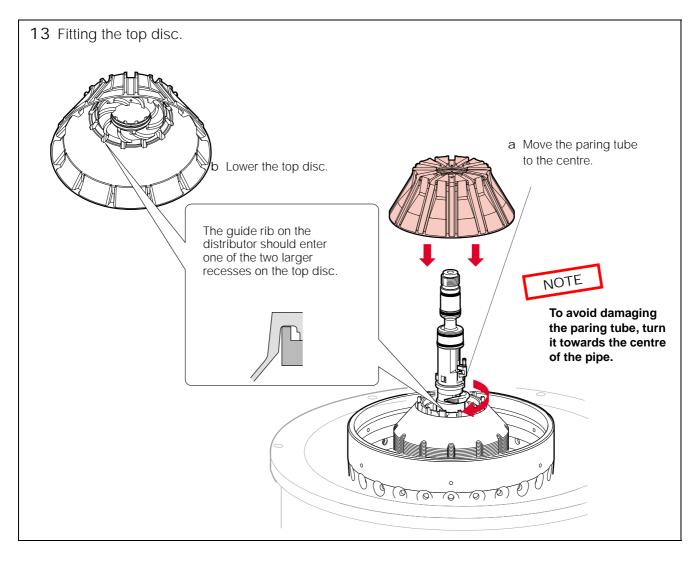


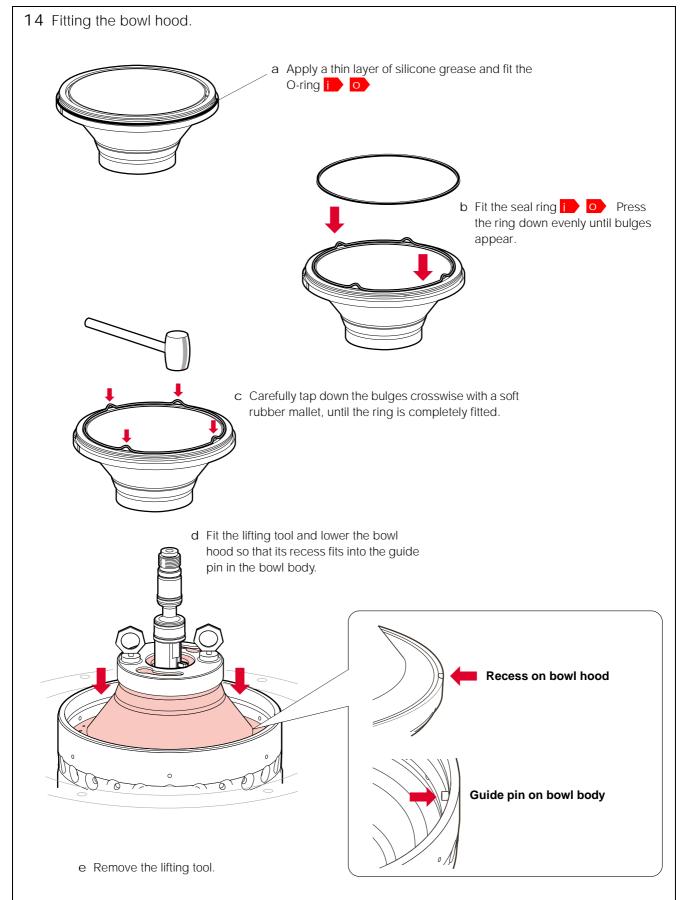
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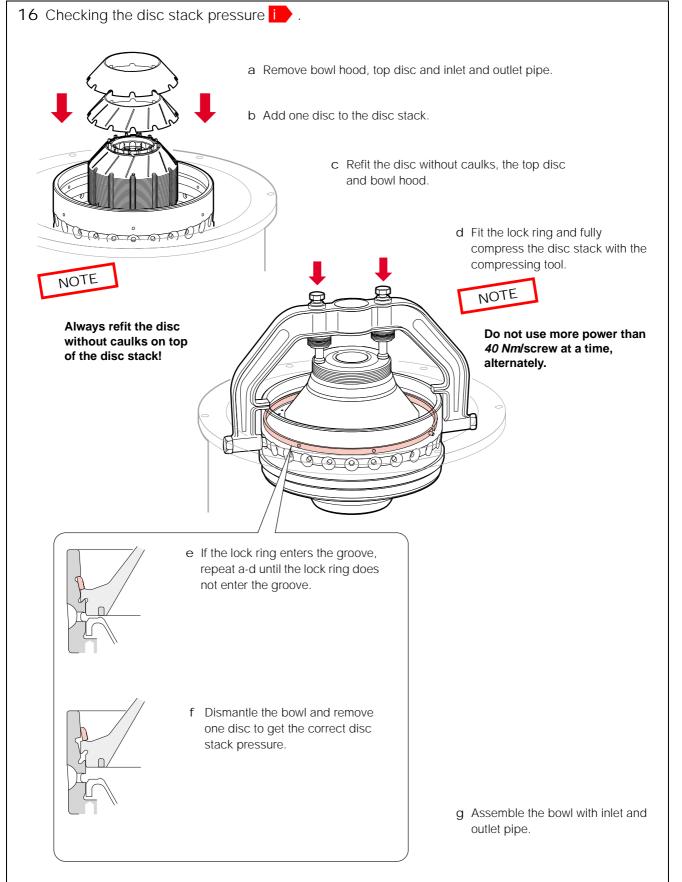


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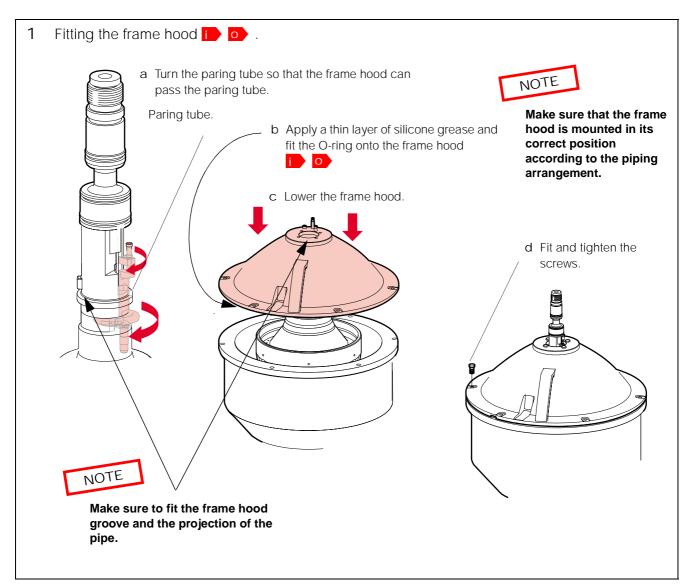




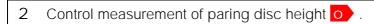
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3.5.4 Frame hood

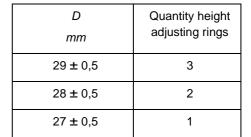


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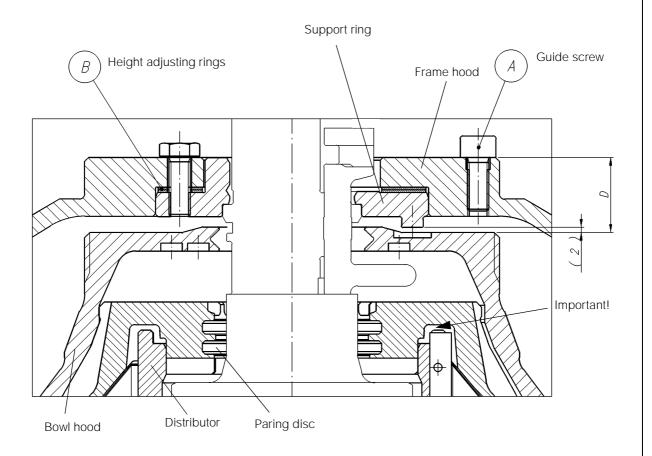


a Remove the guide screw (A).

b Measure the distance *D*. Assemble the correct number of height adjusting rings (B) according to the table.

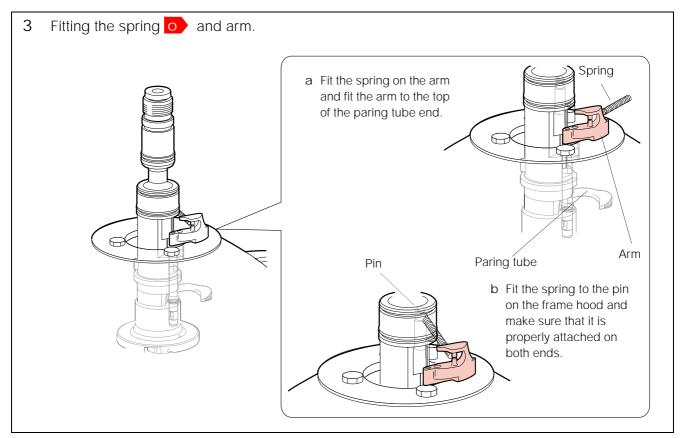


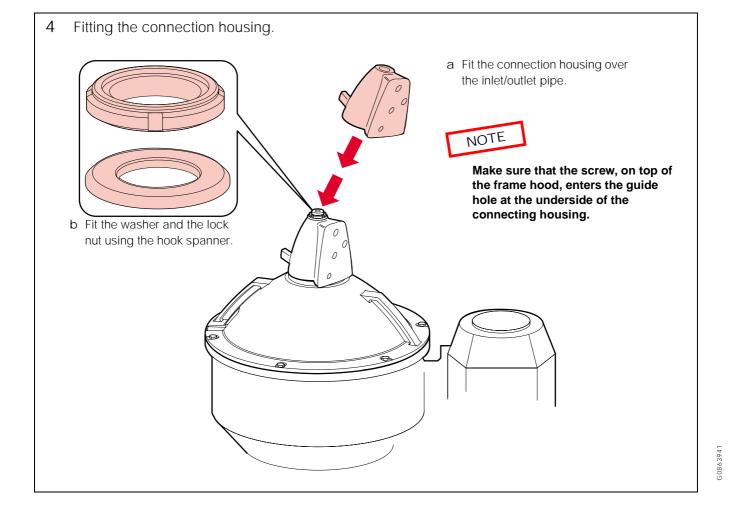
c Refit the guide screw (A)



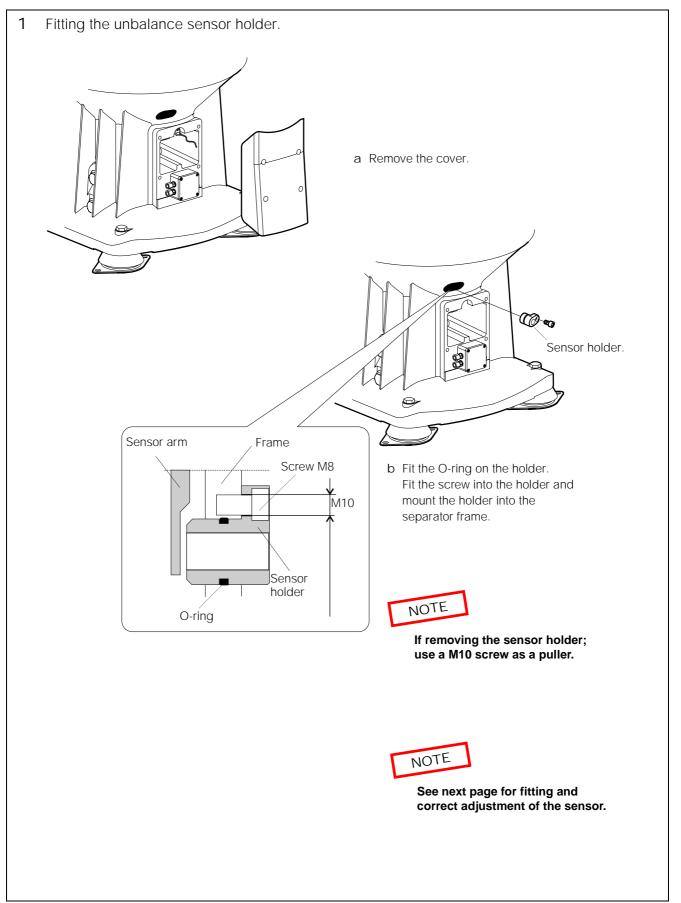
Guide screw

G09115E1



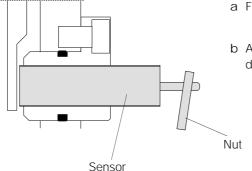


3.5.5 Unbalance sensor (option)

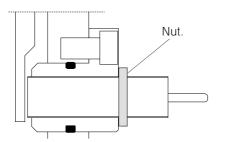






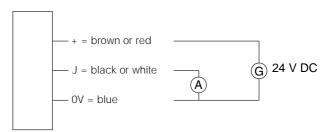


- a Fit the sensor into the holder. Do not forget the nut.
- b Adjust the sensor so that a value of 1,5 appears on the display.



c When correct distance is achieved tighten the nut against the holder.

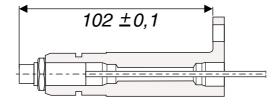
Fit the cover (see previous page).



Adjustment value for the sensor is; 12 mA \pm 1mA. For more details see 2.2 Connection List, page 15 and 752 Unbalance sensor (option)., page 22.

3.5.6 Speed sensor

- 1 Adjusting the speed sensor
 - a Adjust the speed sensor according to the illustration.
 - b Fit the sensor to the frame, see 1.4 Sensors, page 8.

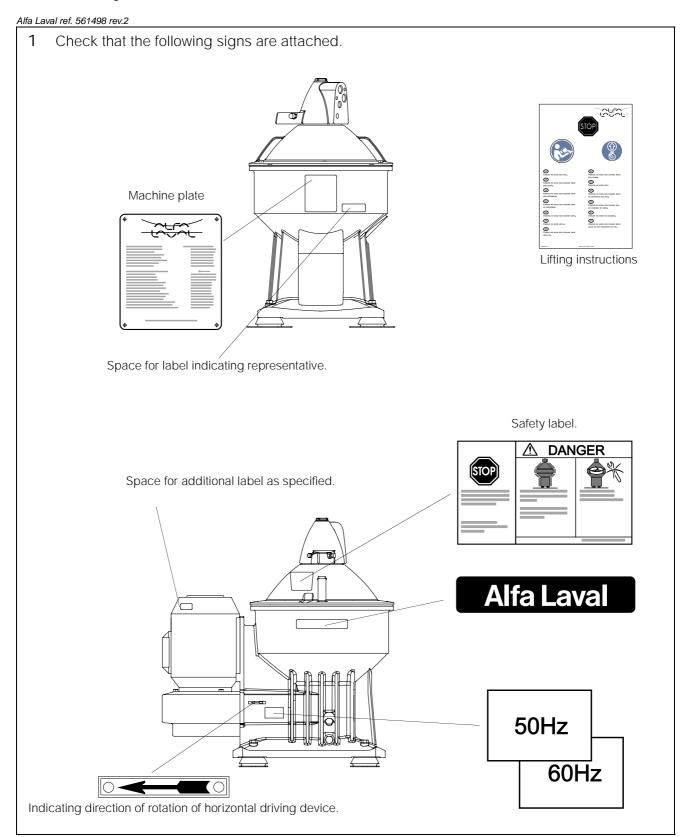


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3.6 Actions After Assembly

3.6.1 Control of machine plates and safety labels



2 Check legibility. Following texts should be read on the labels.



Separator S 840

Manufacturing serial No. / Year

 Product No.
 881203-03-01

 In and outlet device
 563094-01

 Bowl
 561904-04

 Machine bottom part
 562967-01

Max. speed (bowl) 9220 r/minute (50 Hz)

9220 r/minute (60 Hz)

Direction of rotation (bowl) ←

Speed motor shaft 3000 r/min (50 Hz),3600 r/min (60 Hz)

EI. current frequency 50/60 Hz

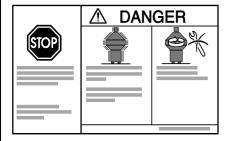
Recommended motor power 9,5 kW

Max. density of feed 1100 kg/m³

Max. density of sediment 2425 kg/m³

Max. density of operating liquid 1000 kg/m³

Process temperature min./max. 0/100 °C



DANGER

Read the instruction manuals **before** installation, operation and maintenance. Consider inspection intervals.

Failure to strictly follow instructions can lead to fatal injury.

If excessive vibration occurs, **stop** separator and **keep bowl filled** with liquid during rundown.

Out of balance vibration will become worse if bowl is not full.

Separator must stop rotating before any dismantling work is started.



Read instruction manual before lifting.

3.7 Oil Change

The separator should be level and at standstill when oil is filled or the oil level is checked.

3.7.1 Lubricating oil

Do not mix different oil brands.

Always use clean vessels when handling lubricating oil.

Great attention must be paid not to contaminate the lubricating oil. Of particular importance is to avoid mixing of different types of oil. Even a few drops of motor oil mixed into a synthetic oil may result in severe foaming.

Any presence of black deposits in a mineral type oil is an indication that the oil base has deteriorated seriously or that some of the oil additives have precipitated. Always investigate why black deposits occurs.

If changing from one oil brand to another it is recommended to do this in connection with an overhaul of the separator. Clean the gear housing and the spindle parts thoroughly and remove all deposits before filling the new oil.



Always clean and dry parts (also tools) before lubricants are applied.



Check the oil level before start. Top up when necessary. Oil volume = see "Technical Data".

It is of utmost importance to use the lubricants recommended in our documentation.

This does not exclude, however, the use of other brands, provided they have equivalently high quality properties as the brands recommended. The use of oilbrands and other lubricants than recommended, is done on the exclusive responsibility of the user or oil supplier.

Applying, handling and storing of lubricants

Always be sure to follow lubricants manufacturer's instructions.

3.7.2 Check oil level

1 Remove the oil pin and make sure that the oil level is above the lower end of the pin.

3.7.3 Oil change procedure

- 1 Remove the oil pin, plug and washer.
- 2 Remove the drain plug.



Burn hazard

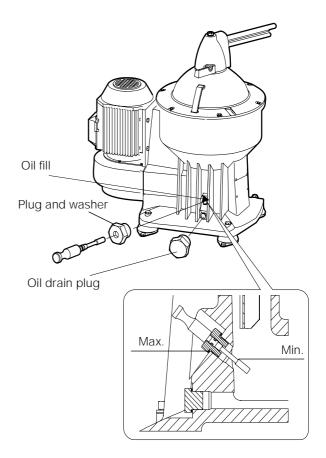
The lubricating oil and various machine surfaces can be sufficiently hot to cause burns.

- 3 Collect the oil in a vessel.
- 4 Fit and tighten the drain plug.
- 5 Fill with new oil until oil flows out of oil filler hole.



See 3.7.6 Lubricating oils, page 128.

- 6 Fit the washer and the oil filling plug. Tighten the plug.
- 7 Fit the oil pin.





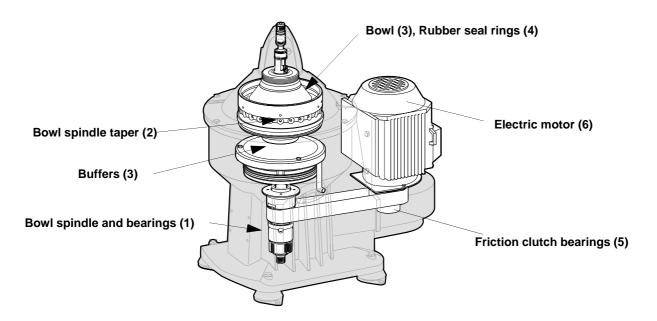
For Inspection service procedures; See "Fill oil in the oil sump." on page 101.

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3.7.4 Lubrication chart

Alfa Laval ref. 567329-01, rev. 0



	Lubricating points	Type of lubricant	Interval
1	The oil bath. Bowl spindle bearings are lubricated by oil mist from the oil bath.	See 3.7.1 Lubricating oil, page 123 Volume: 2.1 Technical Data, page 13 Ambient temperature 0 to +55°C	Oil change: 1. Continous operation: 4000 hours 2. Seasonal operation: before every operating period 3. Short periods operation: 12 months even if total numbers of operating hours is less than stated above
2	Bowl spindle taper.	Lubricating oil, only a few drops for rust protection.	At assembling
3	Bowl : Sliding contact surfaces, thread of lock nut and cap nut.	Pastes specified in 3.7.5 Lubricants, page 126	At assembling.
4	Rubber seal rings.	Grease as specified in 3.7.5 Lubricants, page 126	At assembling
5	Friction clutch bearings.	The bearings are pre-lubricated with grease.	No need for extra lubrication.
6	Electric motor.	Follow the manufacturer's instructions.	Follow the manufacturer's instructions.



Check and pre lubricate new spindle bearings and those that have been out of service for six months or longer.

If not otherwise specified, follow the suppliers instructions about applying, handling and storing of lubricants.



Check the oil level before start. Top up when necessary. Do not overfill.

3.7.5 Lubricants

Alfa Laval ref. 553217-01 rev. 7

Pastes for non-food applications:



The data in below tables is based on supplier information in regards to lubrication properties. Trade names and designations might vary from country to country, contact your local supplier for more information.

Brands with Alfa Laval article numbers are approved and recommended for use.

Manufacturer	Designation	Alfa Laval No.
Fuchs Lubritech	Gleitmo 805 K Gleitmo 705 K	
Dow Corning	Molykote 1000 (Paste) Molykote 1000 (Paste) Molykote G-rapid plus (Paste)	537086-02 (1000 g) 535586-01 (100 g) 535586-02 (50 g)
Rocol	Antiscuffing (ASP) (Paste)	
Kluber	Wolfracoat C (Paste)	

Bonded coatings

Manufacturer	Designation	Alfa Laval No.
Fuchs Lubritech	Gleitmo 900 (Varnish or spray)	
Dow Corning	Molykote D321R (Spray) Molykote D321R (Varnish)	535586-01 (300 ml) 535586-02 (60 ml)

Silicone grease for rubber rings

Manufacturer	Designation	Alfa Laval No.
Dow Corning	Molykote 111 (Compound) Molykote 111 (Compound)	539474-02 (100 g) 539474-03 (25 g)
Fuchs Lubritech	Gleitmo 750	
Kluber	Unisilkon L 250 L	
Wacker	Silicone P (Paste)	

Greases for ball and roller bearings:



Always follow the specific recommendation for lubrication as advised by the manufacturer.

Manufacturer	Designation
ВР	Energrease MM-EP2 Energrease LS2
Castrol	APS 2 Grease
	EPL 2
Chevron	Duralith grease EP2
Elf	Ереха 2
Esso/Exxon	Beacon EP2 Unirex N2
Mobil	Mobilith SHC 460 Mobilux EP2
Gulf	Gulflex MP2
Q8/Kuwait Petroleum	Rembrandt EP2
Shell	Albida Grease EP2
	Alvania EP Grease 2
SKF	LGEP2 or LGMT2
Texaco	Multifak AFB 2

3.7.6 Lubricating oils

Alfa Laval ref. 567330-01, rev. 1

Paraffinic mineral lubricating oil, category (ISO-L-) **HM 68**.

Viscosity grade (ISO-3448/3104) VG 68.

The oil shall follow the requirements in one of the standards below.

Standard	Designation
DIN 51524 part 2 (German standard)	DIN 51524-HLP or HVLP 68
ISO 11158 (International standard)	ISO-L-HM or HV 68

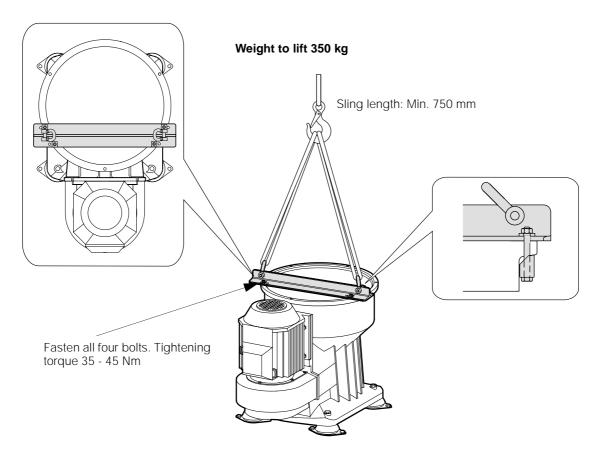
The following is the list of **recommended oil brands**. Trade names and designations might vary from country to country. Please contact your local oil supplier for more information.

Manufacturer	Designation	
Alfa Laval	567334-01	1 litre
	567334-02	4 litres
BP	Bartran 68 Bartran HV 68	
Castrol	Hyspin AWS 68 Hyspin AWH 68	
Chevron	Hydraulic oil AW 68	
Esso / Exxon	Nuto H 68 Univis N 68	
Mobil	DTE 26 (ISO VG 68) DTE 16 (ISO VG 68) DTE 16M (ISO VG 68)	
Shell	Tellus Oil 68 Tellus Oil S 68 Tellus Oil T 68	
Statoil	HydraWay HMA 68 Hydra Way HVX 68	
Total Fina Elf	Azolla ZS 68 Lubmarine Visga 68	

The list of recommended oil brands is not complete. Other oil brands may be used as long as the follow the above standards and have equivalent high quality as the brands recommended. The use of other lubricants than recommended is done on the exclusive responsibility of the user or oil supplier.

3.8 Lifting instructions

3.8.1 Lifting the separator



1 Remove the inlet and outlet device, the frame hood and the bowl according to the instructions in 3.3 Dismantling, page 41.



Never lift or transport the separator with the bowl still inside.

- 2 Disconnect all connections.
- 3 Fit the lifting tool (not included in set of tools). All four bolts on the lifting tool must be fastened to the frame.
- 4 Use two lifting slings to lift the separator. Total length of each loop: minimum 1,5 metres.
- 5 Unscrew the foundation bolts.

6 When lifting and moving the separator, follow normal safety precautions for lifting large heavy objects.



Crush hazards

A falling separator can cause accidents resulting in serious injury and damage.

Never lift the separator by any other method than described in this manual.



When lifting parts without weight specifications, always use lifting straps with the capacity of at least 500 kg.

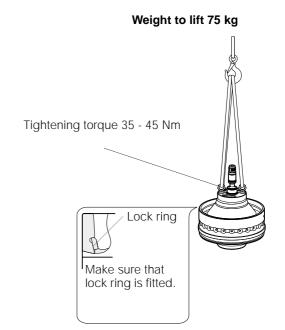
3.8.2 Lifting the bowl

When lifting and moving an assembled bowl, always follow these instructions.

- 1 Fit the lifting tool with lifting eyes to the bowl assembly.
- 2 Check that the lock ring is mounted correctly before lifting the complete bowl.
- 3 Lift the bowl using a sling with the proper rating.



Never try to lift the bowl while it is still in the frame. The bowl body is fastened to the frame with the cap nut.



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4 Change of Circuit Board

If a circuit board has to be changed, proceed as follows:

Note down the run time (days only) as shown in the function list of the EPC 50.

Change the board according to the instructions below.

Go to parameter Fa 90, and insert the run time.

OP-Board

- Switch power off.
- Remove the snap-in transparent cover.
- Disconnect the two cable plugs (do not remove the cables from the plugs).
- Disconnect the flatcable connector at the top.
- Unscrew the five hexagon nuts.
- Mount the new board, and connect in reverse order.

I/O-Board

Switch power off.

If there is no optional board installed:

- Disconnect all the cable plugs on the large board (do not remove the cables from the plugs).
- Unscrew the hexagon nuts. Take care to note where the special nuts for optional board(s) are located.
- Mount the new board, and connect in reverse order.

If one or more optional board is installed:

- Switch power off.
- Disconnect the cable plug(s) on the optional board (do not remove the cables from the plug(s)).
- Disconnect the flatcable connector at the top.
- Unscrew the three hexagon nuts.
- Note the position of the board and remove the board.
- Disconnect all the cable plugs on the large board (do not remove the cables from the plugs).
- Unscrew the hexagon nuts. Take care to note where the special nuts for optional board(s) are located.
- Mount the new board in the same position as the old, and connect in reverse order.

MT-Board

- Switch power off.
- Disconnect the cable plug (do not remove the cables from the plug).
- Disconnect the centrally connected cable.
- Unscrew the four screws holding the board and lift out the board.
- Mount the new board, and connect in reverse order.
- Check that the central hexagon nut is properly tightened.

4.1 Circuit Board Temperatures

Circuit board temperature information can be read as follows:

- Set Pr 7 = 2.
- Push '+' and '-' at the same time ('Standst.' now shows on the display).
- Push '-'

The actual temperature, max. temperature, and the number of times the temperature has been above 70 °C for the transducer scrolls across the display.

- For further circuit board temperatures, push the '-' button.
- To leave the list push the '+' and the '-' buttons at the same time.
- Reset Pr 7 = 0.

5 Cleaning in Place

The use of Cleaning In Place (CIP) equipment is recommended for best separation results. For further information concerning the CIP equipment, see the CIP booklet, bookno. 1817261.

Before connecting the CIP equipment to the Separation Unit, the switch on the control cabinet must be turned to the CIP position. This is so that oil is not accidentally pumped when the pipeline is opened up.

5.1 Cleaning in Place, Separator

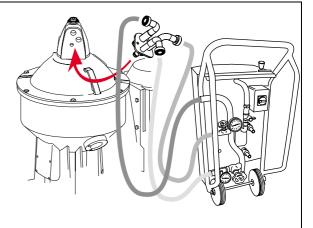
- 1 Remove the pipe connecting plate with pipes from the separator.
- 2 Attach the CIP equipment as shown in the illustration.



The top outlet on the CIP unit should be connected to the top inlet on the separator.

The middle inlet on the CIP unit should be connected to the middle oil outlet on the separator.

The lower CIP inlet should be connected to the lower water outlet on the separator.



5.2 Cleaning in Place, Heatpac® CBM Heater

For systems including a Heatpac [®] CBM heater, cleaning in place of the heater should be carried out circa every 6 months, or according to experience. Cleaning in place of the heater should also be carried out in the event of a pressure drop <u>increase</u> greater than 0.3-0.5 bar (which indicates that the heater is beginning to clog).

We recommend that you use Alfa Laval cleaning liquids. These are specially suitable for the materials used in the Heatpac[®] CBM heater. Liquids that are corrosive to copper or stainless steel, for example hydrochloric acid, phosphoric acid, or nitric acid, must not be used.



Burn hazard

Shut off the oil flow and the heating medium flow before starting maintenance work.



Corrosion hazard

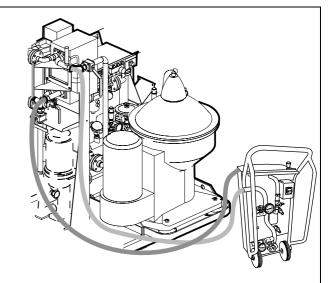
Pay strict attention to the safety instructions for the cleaning liquid used.



Use only specified cleaning liquids. Other cleaning agents may corrode the metal surfaces.

Proceed as follows:

- 1 Close the valves before and after the heater.
- 2 Open the heater drain valve until oil remaining in the heater has drained.
- 3 Close the drain valve.
- 4 Loosen the turnable connections before and after the heater. Turn the connections 90 ° so that the special CIP connections can be connected.
- 5 Connect the CIP equipment. The top inlet on the CIP unit should be connected to the oil outlet on the heater. The hose from the heater inlet should be inserted into the tank and secured with the help of the cover.





The middle and lower CIP unit outlets must be closed.

- 6 Clean with CIP fluid.
- 7 Flush with water.

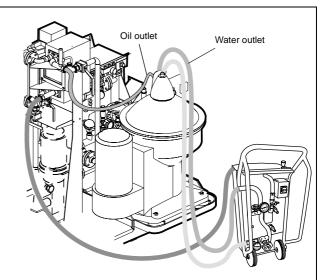
After cleaning:

- 1 Open the heater drain valve until the flushing water has drained.
- 2 Close the drain valve.
- 3 Remove the CIP connections.
- 4 Return the turnable connections to their former positions and re-tighten.
- 5 Re-open the valves before and after the heater.

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5.3 Cleaning in Place, Separator and Heater

Connect the CIP equipment as shown in the illustration. Proceed with cleaning as described above.



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6 Heatpac® CBM Heater (Optional)

6.1 Technical Data

Operating pressure, maximum	1.6 MPa (16 bar)
Test pressure	2.4 MPa (24 bar)
Operating temperature, maximum	225 °C
Medium	Mineral oil
Heating media	Steam, hot water, thermal oil
The following shall apply to the heating media:	
Steam:condensate pH	8.8 - 9.2
sodium in condensate	< 0.01 mg/l
Water:pH value	Shall be neutral to minimize corrosion risk
Thermal oil	The thermal oil must be highly resistant to oxidation and thermal desintegration. It must also have good corrosion protection properties.

6.1.1 Manual Cleaning

Manual cleaning is carried out as follows:

- 1 Disconnect the heater.
- 2 Drain the heater.
- 3 Flush the heater through with fresh water.
- 4 Drain the heater from water.
- 5 Fill the heater with hot cleaning liquid (50-70 °C). Use the type and concentration required for the deposits present.
- 6 Let the liquid stay in the heater for at least 60 minutes. If possible, let the cleaning liquid circulate in the heater.
- 7 Drain the cleaning liquid.
- 8 Flush through with clean water.
- 9 Reconnect the heater using new gaskets.



Take care to reinstall the heater the right way up.

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7 Heatpac® EHM Electric Heater (Optional)

7.1 Technical Data

Media	Mineral oil
Max. testing pressure	2.4 MPa (24 bar)
Operating pressure and media temp	According to PN 16:
	Max. 1.6 MPa (16 bar) up to 150 °C
	Max. 1.5 MPa (15 bar) up to 160 °C
Material:	
Heating element	Aluminium
Pressure vessel	Pressure vessel steel
Cover	Aluminium
Insulation	20 mm mineral wool
Mounting style	Vertically or horizontally
Voltage supply	230, 400, 440, 460/480/500, 690 V AC, 50/60 Hz
Connections	Acc. to DIN standard 2633 or JIS standard B2213
Terminal box	IP 65
Elements; resistance, surface load, output	400 V: 63 Ω, 1.3 W/cm ² , 2.5 kW
	440 V: 70 Ω, 1.4 W/cm ² , 2.8 kW
	460 V: 83 Ω, 1.3 W/cm ² , 2.5 kW
	480 V: 83 Ω, 1.4 W/cm ² , 2.8 kW
	500 V: 83 Ω, 1.5 W/cm ² , 3.0 kW
	690 V see 400 V (= Y-connected 400 V elements)

Tightening Torques

Flange bolts	M16	240 Nm
Ground screw	M8	21 Nm
Connections on elements	M4	3 Nm
Element nut h = 9	M14	70 Nm
Element nut h = 5	M14	30-50 Nm
Relief valve	G1/2	80 Nm
Spring pocket for Pt 100 and safety guard	G1/2	30 Nm
Temperature sensors		80 Nm

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7.2 Dismantling and Cleaning

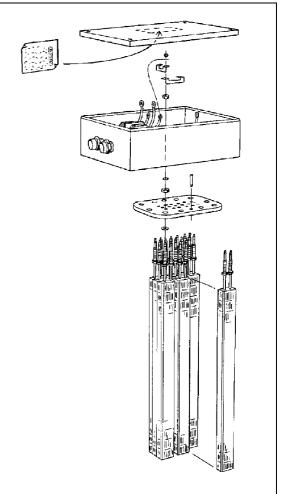
The electric heater requires regular opening for cleaning. The heater block resistance, and the insulation resistance of the heating elements should be checked and an inspection of the general condition carried out.

Any malfunctions of the heater are indicated in the control unit. For further information see the *Alarms and Fault Finding* booklet.

As a general guideline, the heater should be opened up for cleaning whenever an excessive pressure drop occurs, or if capacity falls and oil temperature is low.

Where heavy fuel is used, dismantle the heater when warm as described below:

- 1 Lift off the junction box cover.
- 2 Loosen the cable nipples.
- 3 Mark the signal wires, disconnect them and pull out the cables.
- 4 Remove the flange bolts.
- 5 Remove the earth connections between the flanges and the junction box.
- 6 Lift off the heater insert. If cold heavy fuel has stiffened the heater insert, a couple of screwdrivers may be used to ease off the insert. Avoid using a sling.
- 7 Clean the insert in a bath using Alfa-Laval cleaning liquid part no. 1762852-01 for lube oil heater; part no. 1763500-02 alternatively diesel oil, white spirit, or equivalent for fuel oil heater. Blow all parts dry with compressed air.
- 8 Assemble the heater in reverse order.
- 9 Measure the heater block resistance and the insulation resistance to ground before reconnecting the wires.



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7.2.1 Replacing Heater Element

- 1 Place the heater insert on a work bench.
- 2 Use a box spanner to disconnect the wires and the connecting plates. A wiring diagram is placed on the inside of the junction box cover.
- 3 Disconnect the junction box by removing the nuts on the heater element connecting rods inside the the junction box, using a box spanner. Be careful not to damage the insulation sleeves.
- 4 Remove the junction box.
- 5 Remove the O-rings above the tightening nuts of the heater element connecting rods.
- 6 Remove the nuts using a box spanner.
- 7 Pull out the heater element.
- 8 When reassembling:
- 9 Use a new copper packing.
- 10 Screw fast the elements in the top counter flange.
- 11 Before refitting the junction box, change the O-rings.

For tightening torques, see page 141.



It is very important that the appropriate heater element is installed.

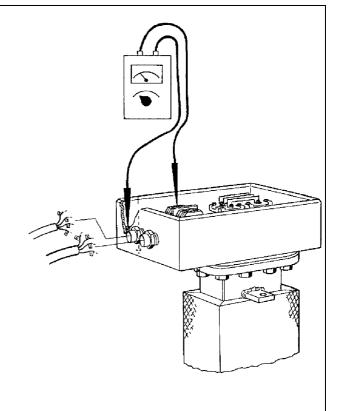
7.2.2 Insulation Resistance Megger Test

The heating elements are electrically insulated by means of compact magnesium oxide. Under certain conditions, e.g. during storage, transport, etc., magnesium oxide can attract damp which lowers the insulation resistance. The insulation resistance between terminal and ground for each heater block must therefore be measured before the heater is taken into use. This is done by means of a megger test.

Megger Test Procedure

- Disconnect the wires from the terminal in the heater junction box before starting measurement.
- Test the insulation resistance for the heater blocks by means of a megger connected between the heater terminals and ground in the heater junction box. The test voltage to use is 500 V DC.

The total insulation resistance for the heater should be ≥ 1 M Ω .



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Action to Increase Insulation Resistance

If the insulation resistance is between 100 $k\Omega$ and 1 $M\Omega$ the heater can be reconditioned in place simply by taking it into use.

Please note that during the first period of operation the insulation resistance can be somewhat reduced before it starts to increase. This is due to the accumulation of moisture in the element top during heating.

In the event the insulation resistance is below $100~k\Omega$ in any group of elements, the elements in the group must be measured separately. The insulation resistance in a single element is measured between the connecting pin on the element, with the closing links disconnected, and the ground.

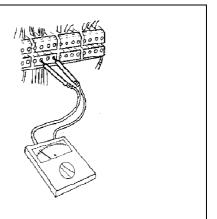
A single element with resistance below 100 $k\Omega$ can be reconditioned in place by indirect warming. Do not connect the connecting pins via the closing link to the terminal. Connect the remaining elements in the block to the terminal and allow the heater to be taken into operation.

New Megger Test

If the insulation resistance at start-up was under 1 M Ω , a new megger test should be carried out after 14 days operation. The elements should now have a resistance of over 1 M Ω If this is not the case, any element still below 1 M Ω should be replaced.

7.2.3 Measuring of Heater Block Resistance

The heater block resistances are measured from the power unit. This ensures that the heater elements and the heater blocks are correctly connected.



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Resistances of available heater sizes and applicable voltage supply are given in the following table:

Heater Block Resistance (Ω)					
Size	Voltage (V)	Part load 1	Part load 2	Part load 3	Part load 4
7 kW	400	42			
8 kW	440	47			
8 kW	480	55			
7 kW	690 V	126			
14 kW	400	21			
16 kW	440	23			
16 kW	480	28			
14	690	63			
22 kW	400	21	42	21	
24 kW	440	23	47	23	
24kW	480	28	55	28	
22	690	63	126	63	
36 kW	400	21	42	21	
40 kW	440	23	47	23	
40 kW	480	23	47	23	
36	690	63	126	63	
50 kW	400	21	42	21	21
56 kW	440	23	47	23	23
56	480	28	55	28	28
50	690	63	126	63	63
65 kW	400	21	42	21	11
72 kW	440	23	47	23	12
72kW	480	28	55	28	14
65	690	63	126	63	32

Terminals for Block Resistance Measuring				
Power unit	Part load 1	Part load 2	Part load 3	Part load 4
	X11:4-5	X11:7-8	X11:10-11	X11:13-14
	X11:4-6	X11:8-9	X11:10-12	X11:14-15
	X11:5-6	X11:7-9	X11:11-12	X11:13-15
Control unit	X11:4-5	X11:7-8		
	X11:4-6	X11:8-9		
	X11:5-6	X11:7-9		
Contactor box			K21:2-4	K22:2-4
			K21:4-6	K22:4-6
			K21:2-6	K22:2-6

8 Heatpac® Power Unit (Optional)

8.1 Technical Data

Power circuits. Up to 24 kW (smaller cabinet)		
31830-6356-1		
Mains supply (3 phase)	400, 440, 460/480/500 V AC +10% /-15% , 50/60 Hz ±5%	
External fuse	Max. 35 A	
Overcurrent protection	Thermal relays, 16-23 A/8.5-12.5 A	
Triac circuit current	Max. 23 A	
Power circuits. 36 kW to 72 kW (larger cabinet)		
31830-6407-1		
Mains supply (3 phase)	400, 440, 460/480/500 V AC +10% /-15% , 50/60 Hz ±5%	
External fuse	Max. 100 A	
Overcurrent protection	Fuses, 25 A, 16 A, 25 A, 63 A	
Triac circuit current	Max. 23 A	

Control circuits	
Control voltage	24 V AC +10% /-15% , 50/60 Hz \pm 5% (from external control unit)
Power consumption (inrush/hold)	31830-6356-1 Max. 120 VA/30 VA
	31830-6407-1 Max. 200 VA/55 VA
General	
High voltage tested at 2000 V	
Max. ambient temperature	55 °C
Protection class	IP 65
Material	Steel
Weight	
Smaller cabinet	40 kg
Larger cabinet	54 kg
External inputs and outputs	
Inputs	Mains supply
	Control signals (24 V AC)
	Aux. contact on contactor for pump
	Pt 100 temp. sensor (to internal high temp. switch).
Outputs	Power to heater
	Safety alarm feedback to control unit

8.2 Working principle

Power for the electric heater is supplied from an external power source via the main switch and the different contactors.

The contactor K11 supplies power to a variable heater load of 0-7/8 kW or 0-14/16 kW, which is controlled from the triac modules A1 and A2. This contactor is activated at all times once the heater is started and as long as the control unit signals no function fault. The remaining contactors (K12 and K16-K17, if applicable) supply power to fixed heater loads as on/off functions in accordance with the size of the heater. By combining the variable load and the fixed loads, an overall stepless heater is achieved.

8.3 Electric Heater Function

By using the proportional and integral (PI) functions in the EPC, it is possible to activate the power unit load functions to feed the electric heater with variable and fixed power.

The power unit is equipped with the necessary contactors, fuses and terminals.

The power unit also holds two triac modules (A1 and A2) for regulating the variable load.

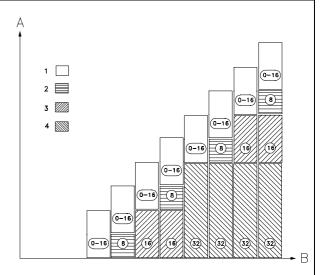
The electric heater requires an extra temperature sensor (on the heater) connected to a temperature switch (in the power unit) to prevent overheating.

8.4 Heating Performance Principle

The oil temperature is regulated from the control unit which gives the appropriate signals to the power unit. The power unit feeds the electric heater with both variable and fixed power.

The fixed power is fed in steps as a constant part load. The variable load operates on top of the fixed part load for fine tuning of temperature.

Sequential switching of the fixed part load and regulation of the variable part load are automatically controlled by the control unit, and results in an overall smooth operation.



- A Load (kW)
- B Size (kW)
- 1. Part load #1 (variable 0 -16 kW)
- 2. Part load #2 (fixed 8 kW)
- 3. Part load #3 (fixed 16kW)
- 4. Part load #4 (fixed 32kW)

Heating Performance Principle for 440 V

8.5 Load Control and Functions

8.5.1 Variable Part Load

Power for the variable part load (#1) is fed via contactor K11 in the power unit and regulated by means of the two triac modules A1 and A2.

Contactor K11 is activated provided that there is a closed circuit through the safety switch (TS) and that there are no function faults in the control unit (see electrical diagram in *System Reference/Installation Instructions*). The triac modules are controlled from the control unit.

The required electric power is then supplied to the heater in accordance with the present load. Contactor K11 is furnished with a variable overload protection relay (F11).

8.5.2 Fixed Part Load

Power to the fixed part loads (#2-#4) is fed via contactors K12, K16, and K17, and controlled from the control unit as on/off functions in accordance with the present load.

The contactors are switched off by the heater safety switch function (TS, K14) in the case of excessive temperature or low oil flow (pump interlocking).

8.5.3 External Safety Stop

The contactor circuits for switching power on/off to the different part loads are interlocked by means of the external safety stop switch (which is connected in series to the internal temperature switch TS), to prevent the electric heater from overheating.

The contactors K11, K12, K16, and K17 in the power unit are connected in series to the internal temperature switch TS. Excessive temperature or no oil flow (pump stopped) will deactivate the contactors, thus switching off the heater.

Overload relays/fuses F11, F12, F16, and F17 in the power unit are used for overload protection.

8.5.4 Start and Reset Functions

During normal operation, the contactors in the power unit are activated from the Control Unit and interlocked by the pump starter and contactor K14. Contactor K14 is interlocked by the temperature switch.

 If the temperature switch has been released, the heater must be restarted using the Alarm Reset on the Control Unit after the cause has been remedied.